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MINERALOGY.

The Mineral Region of South-West Missouri and South-East Kansas.

BY THE EDITOR.

The recent discoveries of lead and zinc in South-Eastern Kansas having created an almost unprecedented rush of adventurous and wealth-seeking people in that direction, and the correspondents of the city papers having written them up in so extravagant a manner that the reality could but fall far short of their descriptions, the writer hereof recently made a trip to the Short Creek diggings for the purpose of satisfying himself of the actual condition of things there. (About two years since he visited and carefully examined the diggings in and about Joplin, Mo., about eight miles East).

The mineral wealth of Eastern Kansas, as developed by the building of the Missouri River, Ft. Scott & Gulf R. R., running from Kansas City to within about eight miles of the diggings, is remarkable in the extreme, and probably can hardly be equaled in the country for diversity of soil and mineral wealth, along a line so short.

Wyandotte County, besides her rich soil and a topography especially adapted for the raising of fruit, furnishes a number of quarries of white magnesian limestone, similar to the Cottonwood Falls stone; also an abun-

dance of excellent blue limestone. Salt water has also been found in large quantities and of a strength almost sufficient, even in these days of cheap salt, to pay for manufacturing, while from the same well a natural gas forces its way out in quantity sufficient to heat and light a large city, and of a quality almost equal in candle power to the best artificial gas.

In Johnson County, which is one of the richest agricultural regions in the State, coal has been found at a depth of 530 feet, in a vein three and one-half feet in thickness, and thinner veins crop out at several points within its borders. Building stone abounds, and hydraulic cement, red ochre, fire and pottery-clay have been discovered in various localities in the counties.

In Miami County coal is found on all sides, though so far only in thin veins; the presence of petroleum is manifest in many places, building stone of the best quality and the well known "Fontana marble" abound, and recently discoveries of lead in the Southern portion of the county have been reported.

In Linn County the coal assumes a more prominent position and crops out of nearly all the hillsides and banks of streams in the Eastern and Southern portion of the county. At a depth of ninety feet a three and one-half foot vein has been struck at Barnard, where also the famous "Barnard sandstone" has been discovered and taken out in large quantities. This stone has been largely used in this city and is not only very valuable, but is also very handsome in appearance.

Bourbon County, which is probably the best in Kansas as a manufacturing district, abounds in coal of two kinds—the rusty or surface coal, which is the best for fuel, and the black or gas coal. Not less than 250,000 tons are mined in this county annually. Limestone and sandstone are also found on all sides: also hydraulic cement, fire-clay, pottery-clay and mineral paint. Lead also has been discovered in a limited amount.

Crawford County also abounds in coal, in veins running from five feet in thickness downwards, while limestone, sandstone and slate are found in abundance.

Cherokee County furnishes large amounts of coal, which is found almost universally at a depth of from ten to fifty feet and in strata varying from twelve inches to four feet in thickness. Sandstone, limestone, fire and pottery-clays also abound. Lead and zinc ores have been recognized as present for several years, but have not been, until recently, believed to exist in paying quantities. The late discoveries of these metals above alluded to have been made in Cherokee County, about eight miles North-eastwardly of Baxter Springs and, from present indications, will soon equal in importance those of South-west Missouri at Granby, Minersville and Joplin.

The counties in Missouri just across the line from those in Kansas, above described, show similar mineral developments, while on both sides of the State line the agricultural products of the several counties are fully equal to the best of any of the counties in either State, and the Missouri River, Ft. Scott & Gulf R. R. is tasked to its fullest capacity to transport the immense agricultural, horticultural and mineral productions of this territory.

The mining district of Jasper County, Missouri, and Cherokee County, Kansas, embracing jointly the lead diggings at Joplin and Short Creek, being of the same general character, may be described together, Joplin being, as far as is indicated by discoveries made up to this time, the centre of the mineral field. This whole lead region belongs, according to Professors Schmidt and Leonhard, to the sub-carboniferous system, the formation consisting of limestone and chert beds belonging to the upper part of the so-called Archimedes or Keokuk limestone. In some places the ore deposits are found overlaid by sandstone, either ferruginous sandstone or coal measure sandstone, and lie, as a rule, horizontally rather than vertically, being usually associated with silicate of zinc, or carbonate of zinc, which are rather indiscriminately called "jack" by the miners of the different diggings. Sometimes, however, it is found as "float mineral" in loose sand or clay, and not infrequently impregnating the limestone and chert, or, quite as often probably, it is found broken up and mixed with limestone, dolomite and in various conglomerate rocks.

The lead ores are usually found in the shape of Galena or sulphuret of lead, though it is common in the form of carbonate or "dry bone."

The zinc ores are found in the form of Blende or Sulphuret, and Silicate or Calamine. Carbonate of zinc is also found in connection with Calamine and, from its beautiful white and sometimes crystalline form, called by the miners "white jack."

Iron Pyrites, "the fool's gold," is also frequently found in these mines, and known as "mundic" among the miners.

Dolomite or Brown spar, usually designated as "soft tiff" to distinguish it from calcite or "white or glass tiff" and barytes, which is known as "bald tiff," forms in many mines in South-West Missouri and South-Eastern Kansas the principal gangue of the ore deposits. Calcite, calcareous spar, carbonate of lime, forms what is commonly called "glass tiff" or "hard tiff" and is frequently found in these mines. Quartz also, in crystals of pyramidal or prismatic forms is of frequent occurrence, and bitumen is frequently associated with the lead ores throughout this whole region.

The general geological section of the lead and zinc bearing formation of South-West Missouri is given by Prof. Schmidt, as follows:

a.. 1 foot to 3 feet Soil.
0 to 5 feet Gravel.

b.. 0 to 15 feet Sandstone.
0 to 5 feet black slate, with Coal.

c.. 20 to 75 feet Chert, more or less broken up, sometimes in fissured layers, and in some localities, especially at Granby, altered to soft, porous Chert. The Chert is invariably accompanied by large masses of Clay and Sand.
0 to 20 feet Silico-Calcite.
0 to 30 feet alternate layers of Limestone and Chert.

XUM

d.. { 140 feet or more Limestone; in some places gray and coarse grained; in others bluish and fine-grained.

(*a*) Alluvium. Frequently contains some ore in loose pieces.

(*b*) Probably Lower Coal Measures, with occasional occurrences of ore.

(*c* and *d*) Upper layers of Keokuk Group. Also called Archimedes Limestone. (Sub-Carboniferous system).

(*c*) Represents the principal ore-bearing strata: (*d*) the bed rock in which no ore has as yet been discovered.

We take from the Geological survey of Missouri, 1873–4, by Prof. G. C. Broadhead, the following geological history of the region under consideration:

PERIOD OF DEPOSITION. | *First Period.*—Original deposition of the various stratified rocks, namely: The "Bed Rock," the alternate layers of Limestone and Chert, the Silico-Calcite, the Slates and Coal, and of the Sandstone.

These several strata, after their deposition, probably remained unaltered for a very long time and became dry, hard and dense before the second period began.

PERIOD OF DOLOMIZATION | *Second Period.*—Local dolomization of certain strata of Limestone. Disturbances and ruptures in the Chert in consequence of the contraction of the Limestone during the metamorphoric action. Principal deposition of the ores from watery solution.

This metamorphic action was confined to a part of the alternate layers of Limestone and Chert, and very limited in its vertical extent—rarely exceeding 20 feet.

The dolomization of the Limestone, and the simultaneous deposition of the ores, began either from horizontal crevices and then extended through the whole mass of one stratum of Limestone and was limited by the layers of Chert above and below, or it began from vertical crevices in the Limestone and formed a mass of Dolomized Limestone, with ore extending along the crevice between the Chert layers, and generally from three to ten feet wide. In the first case the "openings" of Granby were formed, in the second the "runs" of Joplin.

PERIOD OF DISSOLUTION. | *Third Period.*—Dissolution and removal of a part of the Limestone from the Silico-calcite and from the alternate layers of Limestone and Chert. Gradual breaking down of the remaining concretions and of the layers of Chert, and of the strata above. Continued deposition of ores in diminished measure.

In this period the immense accumulations of broken Chert were formed, which in so many places overlie or accompany the ore deposits. The ore (nearly always Galena) was deposited, in many places, in the fissures and little cracks of the broken Chert beds, in sheets between these layers and in

crystals adhering to pieces of broken Chert, sometimes on all sides of the fragments, showing plainly that the Galena was formed after the Chert had been broken.

PERIOD OF REGENERATION.

Fourth Period.—Local regeneration of the partially dissolved and softened Limestone by renewed deposition of Carbonate of Lime. Local infiltration of Quartzite. Continued deposition of ores.

All the conglomerates which consist of Chert-fragments, cemented either by a silicious or by a calcareous mass, the cementing mass inclosing crystals of Blende or Galena, were formed in this period.

PERIOD OF OXIDATION.

Fifth Period.—Oxidation of the metallic Sulphurets, and alteration of these Sulphurets into Silicates and Carbonates.

During this period the Galena, in many deposits, was more or less altered into Cerussite and Pyromorphite, the Blende into Calamine and Smithsonite, and the Pyrites into Limonite. Some of these minerals also, while in solution, were carried over larger or smaller distances and re-deposited as seams or impregnations in Sands, in Clays or in Chert Breccia.

The local corrosion and partial dissolution of the Chert, and its alteration into a porous and more or less friable mass, must have taken place after the deposition of the ores. This is proved by the entire absence of ores in the porous Chert. This corrosion, therefore, belongs to the Fourth and Fifth Periods, and probably continues to the present day. Also, the oxidation of the ores undoubtedly yet continues.

All these mechanical and chemical actions which, according to present appearances, are confined to the upper layers of the Keokuk Limestone, have taken place over a very large area in South-West Missouri, but with different intensities and effects in different districts and localities."

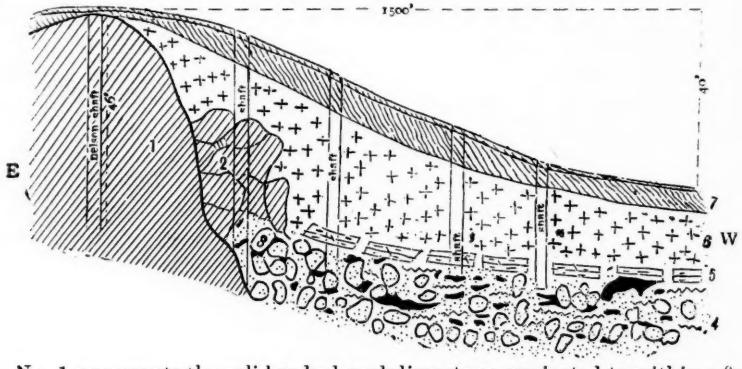
The stratifications in the Joplin district are generally very irregular in their character and relative positions and often vary considerably within short distances, the succession of rocks often remaining the same for long distances but the layers being of very variable thickness and dipping with the slopes. The materials in the bottom lands seem to be principally vast deposits of sand, drift and chert, with occasional masses of Galena, known as "float mineral."

Owing to the exceedingly disturbed condition of the geological formations, it is almost impossible to form any opinion as to the existence or non-existence of lead or zinc ores from any surface indications, any previous experiences as a miner, or from any scientific teachings in the schools or other mining regions, even in the same State.

In the Joplin district the ore deposits are mostly to be found in "runs," usually from one to five feet in thickness, extending horizontally between

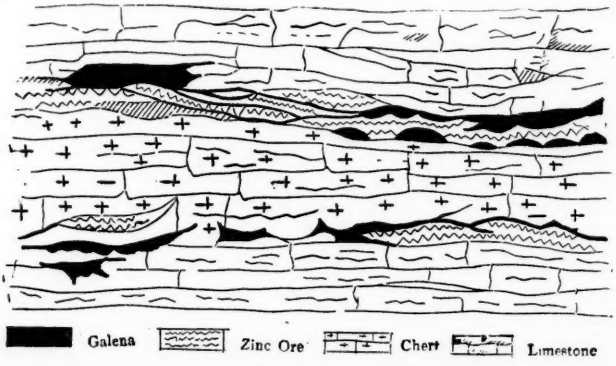
layers of chert above the bed-rock Limestone, marked (*d*) in the table on page 387, though, as before stated, it is sometimes found as "float mineral" in the clay diggings.

We give below a cut showing a longitudinal section of a run at Swindle Hill diggings, near Joplin, among the most productive of any in the whole region, by an examination of which the disappointed miner can at once see how it may happen that he may spend his time and money unavailingly, while his nearest neighbor may be very successful.



No. 1 represents the solid or bed-rock limestone, projected to within a few feet of the surface; No. 2, rotten limestone; No. 3, rotten sandy limestone boulders; No. 4, run of ore, with both Galena and zinc blende among the boulders; No. 5, broken chert layers, capping the run; No. 6, loose broken chert; No. 7, clay. This may be regarded as being as nearly a representative or typical lead mine of the Joplin region, as anything that we can give, and the miners of that region will at once recognize it as such, though, of course, mines are different in details. Going westwardly from Joplin, the same general geological formation prevails and the miners at Leadville, Mo., and Short Creek, Kansas, experience much the same difficulties in mining and meet with about the same degree of success.

We give a sketch of a section of an old shaft at Leadville, which is but



about three miles from the Short Creek mines, and may be regarded as a fair representation of the condition and position of the lead and zinc ores in both localities.

The only general conclusions to be derived from a study of these mining regions seem to be that digging in bottom lands for "float mineral" is a very uncertain thing; that sinking shafts into or below the bed-rock limestone is useless; and that the principal ore-bearing stratum is composed of chert, clay and sand, the metamorphic conglomerate mixture of chert and limestone and the alternate layers of chert and limestone, all of which are usually immediately above the solid bed-rock limestone formation.

The city of Joplin, Mo., is well built, healthful and contains a population of about 8,000 people, whose support comes principally from the lead and zinc industry.

The towns of Galena and Empire City, rival places on opposite sides of Short Creek, in Kansas, have, within a few months, attained a population of some two thousand or three thousand people, and are growing rapidly. Among the best mines in these diggings are the "Labette," Robinson & Co., on the lands of the South Side Mining Co.; the "Blackwell" shaft, Blackwell & Co., on the Empire lands, north side of Short Creek; the "Discovery" shaft, McPherson & Co., on Empire lands, south side of Short Creek; Harper & Co. shaft, one of the best paying on Short Creek; "McBratney & Mitchell" shaft, S. S. Mining Co.; and the "Nevada," Cummings & Co., all of which are located on the bottom lands, except that of McBratney & Mitchell and the "Nevada."

The amount of lead taken out of Joplin annually amounts to many millions of pounds, while even at Short Creek it reaches from 200,000 to 300,000 pounds weekly. At the latter place great activity exists, hundreds of shafts having been sunk on both sides of the Creek, and above and below Galena and Empire for several miles, while prospecting is progressing energetically in every direction. At the Bonanza diggings a smelter is in full operation, while another is nearly finished just below Galena. Large amounts of mineral are being taken out at various points, both on the uplands and in the bottoms. Last week Mr. Cummings struck a rich vein of Galena, said to be from six to eight feet thick, in the "Nevada" mine, South side diggings, and took out about 2500 pounds in one day. Several other good strikes were made about the same time, near the same locality, and if these "finds" indicate anything, it is that the diggings in the direction of Joplin are the most promising. This idea has gained ground rapidly, and has greatly stimulated work in that direction of late, and also on Shoal Creek.

Other mining camps are being settled in the vicinity of those already described, at Webb City and other localities, and the zinc works at Cherokee, Kansas, are being remodeled and enlarged, by gentlemen of abundant means and enterprising dispositions, and it is believed that but a few years will elapse before the region of South-west Missouri and South-eastern Kansas will be the centre of a vast manufacturing interest and furnish homes for hundreds of thousands of busy and thrifty artisans, laborers and farmers.

XUM

THICKNESS OF THE MISSOURI COAL MEASURES.

BY PROF. G. C. BROADHEAD.

In a volume published by its author, S. A. Miller, in Cincinnati, 1877, we find the following table of thickness of coal formation in various fields:

Nova Scotia	14,570 feet.
Pennsylvania	8,000 "
Tennessee	2,500 "
Ohio	2,000 "
Illinois	1,200 "
Missouri	640 "
Kansas	2,000 "

Nebraska greater than last.

It is a great pity that Mr. Miller, in making up his figures, did not consult the latest authority. If he had written to me it would certainly have afforded me very great pleasure to have made out a careful statement for his use. Under the circumstances we feel that justice has not been done to our State. Here in Missouri we know his figures to be wrong. Prof. Swallow, in his geological report of Missouri for 1865, from preliminary examinations, makes our coal measures 640 feet thick. This is where Mr. Miller obtains his figures. Since then, Swallow, myself and others have made more extended and careful investigations, and found our measures to be much thicker.

In such a useful work as that of Mr. Miller's, we regret very much that he has not the later and more correct figures; for these appear comparative with those of other districts, and may be read afar off and regarded as authority.

In 1873 Prof. Swallow, with Campbell's map of Missouri, published a later geological sketch of Missouri, in which he says:

"We have observed about 2,000 feet of coal measures in Missouri."*

During the year 1859, 1860 and 1861, whilst acting as assistant on the first geological survey of Missouri, much of my time was occupied in examinations of the coal measures, particularly the Upper measure of Missouri. From notes then taken I prepared a careful section of the coal measures, and found the Upper measures to be 1,284 feet thick. At the same time I obtained from other observers of Missouri geology data from which I calculated the thickness of the Middle Coal Measures in North Missouri to be 300 feet and the Lower measures 500 feet, or a total of coal measures in Missouri of a little over 2,000 feet thickness. The result of these notes was the publication by myself, in 1865, of an extended paper, with a complete section on the Coal Measures in the transactions of the St. Louis Academy of Sciences.

*Dana's Manual of Geology, 1874, gives 2,000 feet.

In 1872 I carefully re-examined the Upper Coal Measures of Missouri, revising the field work of nearly all my previous sections, and constructed an entirely new section. In this I found the observed sections to foot up 1,267 feet of Upper coal measures. To this should be added not over 40 feet for a break in the connection in Atchison and Holt counties, and we would have a little over 1,300 feet for the total thickness of the Upper Coal Measures, differing not over 20 feet from my former work, all resulting from a careful comparison of several hundred different sections.

The Middle and Lower Coal Measures differ somewhat in thickness in different portions of the state. My section of the Middle Coal Measures of North Missouri made in 1872 make them 323 feet thick. Observations in 1871 along the line of the Pacific Railroad in Johnson County make the Middle Measures 327 feet and the Lower Measures 290 feet.

In 1873 examinations in South-West Missouri made the Lower Measures in those counties about 300 feet thick and the Middle Measures over 300 feet in thickness.

METEOROLOGY.

The Connection Between Storms and Sun-Spots, with Record of the Celebrated Storms of 1600 Years.

BY COL. HENRY INMAN, OF KANSAS.

This year has been, in the United States, one of severe and remarkable storms. Their rapid succession and destructive results has provoked popular comment, and created serious alarm. This series of terrible atmospheric disturbances, which in nearly every instance have been unprecedented in their grandeur and destruction, invites the suggestion that there must be some special influence to account for the apparently exceptional meteorological phenomena of this season. It has prompted an examination of the dates of some of the most remarkable storms that have occurred in the last sixteen hundred years—a partial list of which is here presented. If a complete record were possible of all the violent storms of historic times, an investigation of all the data in reference to their cause would undoubtedly develop the fact that the remarkable atmospheric disturbances of the present season should not be regarded as anomalous, but have been manifested in strict obedience to a law or complication of laws, that themselves recur, and with them their accompanying phenomena, in cycles whose period is a constant number. It will be observed by a careful comparison of dates, that the most violent and destructive storms of record meet the requirements of the hypothesis (of the principle of which, further on). It will also be

observed that the great storms to which reference is here made, or at least a large proportion of them, have extended over areas fully equal to any that have visited this continent the present season. Unquestionably the disturbing cause this year is the same as that in the years of the greatest frequency of remarkable storms that have passed. Lightning the most vivid, thunder the most deafening, and earthquake shocks characterized the terrible storms of history, as they have been the prominent features of this year's meteorological record, pointing conclusively to the fact that they have been, and are at each returning cycle, magnetic in their origin.

The cause of these periodical years of violent storms, it is conceded, is clearly due to the unusual magnetic activity of the earth at that time and the dependence of this upon the sun's condition as to the areas and number of spots. The phenomena of their increase and gradual decrease through constant periods has been established by the untiring daily observations of the celebrated German astronomer, Schwabe, (covering nearly thirty years), and the confirmation of his discoveries by other eminent observers. Schwabe found that the solar spots increase in magnitude and frequency for about five years and a half, and decrease through an equal period, completing the cycle in about eleven years. Professor Loomis in one of his recently published works—"an Analysis of the Observations of many years,"—shows conclusively "an existence between the sun-spot period and the intensity of terrestrial magnetism." It is subject to proof that the meteorological disturbances under consideration are purely magnetic, the effects as we see them purely local, and not universal but erratic. These magnetic variations, the results of which are violent storms on the earth's surface, were once considered fitful —their cause having been suspected, but not believed periodical—are equally with other distinct natural forces cosmical in their character. Lesser cycles than that of eleven years have been suspected by some observers, and a long one of fifty-six years due to the conjunctions—successively of Saturn and Jupiter. The theory of Professor Tice is of the same nature, relatively, and the disturbances which he ventures to predict are magnetic in their causes, but based upon the distinct effect of the planets, successively, on the earth at their equinoxes. His theory, in a measure, must be correct and in accordance with now known laws, but whether his predictions as to precise localities and exact dates are not rather the result of too great an enthusiasm, will admit of discussion. We are now approaching the period of maxima of sun-spots, (1879), and also the fifty-six-year period, (1884), and may expect all the fury of its attendant phenomena for the next ten years, with a culminating force at the latter date, unless, as believed by LaPlace, there is always some compensatory law which interferes at the proper time to readjust any impending clash. An attempt has not been made to record all the great storms of history, the difficulties of gathering such a list being obvious. But sufficient data, both ancient and colonial, has been examined to prove that so far as remarkable seasons are concerned, this is no more so than

hundreds of others that are buried in the mighty past—that the years, or periods of sun-spot, actually, taking them one with another for centuries, have been just as fruitful of violent storms as the present one, and that the solar radiation has not materially differed from its present intensity, increasing and decreasing at regular intervals only, it recurring maxima and minima affecting the earth as its meteorological history has shown and we have experienced in our own time.

In A. D. 234, a terrific cyclone visited Canterbury, England, that threw down two hundred houses and killed a number of families. In 277, a violent tempest raged at London, destroying many lives and much property. At Winchester, in 301, a destructive hail storm passed over that place, during which hailstones fell that were larger than hen's eggs. In 420, during a severe storm at Carlisle, a number of houses were blown down, and a great many people killed. In 349 a terrible hail storm extended over the greater part of Britain, killing many people and large numbers of cattle. In 459 a most destructive storm visited London, which destroyed hundreds of houses and killed two hundred and fifty of the inhabitants. Another in Lincoln in 701 blew down over one hundred houses. At Cambridge, in 919, forty houses were destroyed in a tornado. In London again, in 944, fifteen hundred houses were blown down by the force of the wind. In 1055 London was revisited with another terrible storm, and four hundred houses were demolished. On the 5th of October, 1091, a violent storm extended over the whole of England, carrying terrible devastation in its course, but was especially severe in Gloucestershire, where it destroyed all the churches and many other buildings. On the 17th of the same month, in the same year, a storm passed over London, throwing down fifteen hundred houses and unroofing Bow Church. In 1194 a violent storm almost desolated a great part of Denmark and Norway; many lives were lost and houses overthrown; the grain in the fields was destroyed by hailstones as large as hen's eggs. It thundered and lightened for fifteen consecutive days, with a succession of terrible tempests. In 1233 the chimney of the chamber where the Queen of King Henry III and her children lay was blown down, and the whole apartments at Windsor shaken. This storm was accompanied "with such thunder and lightning as had not been known in the memory of man.". In 1251, as King Edward I and his Queen were talking together in their bed-chamber, a flash of lightning struck in at the window, passed by them, killed two of their servants present, but did their majesties no harm. In 1285, when Edward III was on his march, and within 84 miles of Chartres, "there happened a storm of piercing wind that swelled to a tempest of rain, lightning and hailstones, so prodigious as instantly to kill six thousand of his horses and one thousand of his best troops." In 1479 a storm passed over Huntingdonshire, in which the hailstones measured eighteen inches in circumference. In 1510 a storm of fearful violence in Italy "destroyed all the fish, birds and beasts" in an immense area of country. On new year's day, 1515, a terrific storm in portions of Denmark rooted up whole forests, and blew down the

steeple of the great church at Copenhagen. In the same year, and the succeeding two years, terrible storms occurred in Northamptonshire, in which "the hailstones measured from seven to fifteen inches around." On the 3d of September, 1658—the day that Cromwell died—a most terrible and destructive storm extended all over Europe. In 1696, during a fearful storm in the Bay of Cromer, two hundred vessels, with all their crews, were lost. In the same year, April 29, a hail storm raged at Cheshire, Lanconshire, and other parts of England, that killed fowls and knocked down horses and men. On the 4th of May, in the same year, in Herefordshire, hailstones fell that measured fourteen inches in circumference, "destroying trees and green fields in a terrible manner." One of the most fearful that ever occurred in England—November 27, 1703, unroofed hundreds of houses and churches, blew down chimneys and steeples, and tore whole groves of trees up by the roots. "The leads of large buildings were rolled up like scrolls of parchment, and several boats and barges were sunk in the Thames." The royal navy suffered the greatest damage. It had just returned from the Mediterranean, and "one first rate, one second rate, four third rates, and four fourth rates were wrecked, and over fifteen hundred sailors lost." A large number of merchant vessels were also lost. In the city of London the damage was estimated at five millions of dollars. The Carolinas were terribly devastated by storms in the months of August, 1722–8. At St. Kitts twenty ships were lost. On the 30th of June, 1733, at the mouth of the Ganges, in India, a most fearful storm destroyed twenty thousand vessels of all kinds, among which were eight East Indiamen. In this storm three hundred thousand lives were lost. The tide rose forty feet higher than usual. Another at Nantes occurred on the 7th of March, 1741, when sixty-six vessels and eight hundred sailors were lost. On the 10th of August and 8th of December, 1751, during severe storms at Cadiz, and on the South Carolina coast, shipping was destroyed to the value of three hundred thousand dollars. In a storm at Girginti, in Italy, on the 4th of May, 1761, "the hailstones weighed a pound and a quarter and did immense damage." On the 18th of April, 1772, at St. Iago, "hailstones fell as large as oranges." On the 16th of July, of the same year, a terrible tempest raged at St. Kitts, which devastated that and adjoining islands. On the 30th of August, the same season as the above two terrible storms, a fearful tornado visited Boston. In July, 1773, fearful storms occurred in Cuba, and Algenon, in France. The hail was awfully destructive, the hailstones measuring six inches in diameter. Antwerp, and other places in Holland suffered from a severe storm on the 3d of August, 1774, when the hailstones weighed nearly a pound, which killed horses, cows and other animals, and totally destroyed the growing crops. The whole of the West Indies was visited again on the 11th of June, 1776—one of the most severe storms ever known. Another storm occurred at Jamaica on the 6th of September, of the same year. Over the whole of England a most terrific storm raged for three days in January, 1779. Madeira was the scene of a fearful storm on the 26th of July, 1782. Thirty thousand dollars worth

of glass in the windows was destroyed—some of the hailstones weighed a pound. Surat, in the East Indies, had several thousand of its inhabitants killed in a violent tornado on the 22d of April in the same year. Dienpole, in Moravia, was totally destroyed by a storm on the 30th of May of the same year. On the 17th of June, of the same season, immense damage was done all over America, particularly on the New England coast. On the borders of France and Spain, in 1784, hailstones fell during a series of storms that weighed nearly a pound and a half. One hundred and thirty-one villages and farms were laid waste in France on the 5th of August, 1785. A terrible tempest raged in the English channel in July, 1786, and many large and small vessels were lost. Ferrara, in Italy, was visited by a terrible hail storm on the 17th of July, of the same year. This storm apparently extended over a part of England. At Highlickington, in Devonshire, on the same day, thirteen large elm trees were removed nearly three hundred yards from the original spot and remained standing in a flourishing condition. At the same time and place, a large rock was torn in two and the pieces separated eight feet. All the poultry and grain for miles in that region was totally destroyed by the thunder and lightning. In 1786–7 hail storms were general all over England and in the West Indies, particularly in the Bench Islands, where the destruction of property was terrible. On the 13th of July, 1788, at St. Germain en Laie, in France, hail fell as large as a quart bottle. All the trees from Valance to Lisle were torn up by the roots. This storm extended over the whole kingdom and did immense damage. On the 23d of December, 1790, another terrific storm raged all over France, carrying devastation in its path. In September, 1791, a violent hail storm fell in Calatria, near Naples, where the hailstones weighed a pound and destroyed all hopes of a vintage. In October, of the same year, during a fearful storm, the Church of Spildhurst, in Kent, was destroyed by lightning, the bells were melted, and other damage to the town sustained. In March, 1793, a terrific storm visited Sussex—the hailstones were four inches in circumference. At Whitehaven this storm did great damage, and the tide rose six feet above its usual height. In August, of the same year, hailstones fell at Thornton, in Liecestershire, that measured six inches and a half in circumference, doing immense damage. On the 2d of June, same year, a fearful storm visited Jamaica. On the 16th of July, 1794, an almost universal storm in Great Britain caused devastation in its track. In the Barracks, at Bletchington, nearly a thousand panes of glass were destroyed, and other damage done. On the 25th of September, 1798, a terrible storm visited Halifax, and half a million dollars worth of property was destroyed. On the 19th of August, 1800, irregular pieces of ice fell in Oxfordshire the size of hen's eggs The same storm did great damage in Bedfordshire, where hailstones fell eleven inches in circumference, killing all the partridges and hares, and destroying all the grain in the fields. On the 8th of November, of the same year, great damage was done in London again, and throughout all England. In November, 1801, a terrible storm visited the whole of North of England.

On the 18th of August a violent hurricane of wind did great damage in Devon and Cornwall. This same storm blew down a stone wall at Sherfield-place, three hundred feet long. Two days afterwards a dreadful storm occurred at Kingston-upon-Thames (probably the same storm). On the 6th of July, 1805, a terrific thunder storm passed over Somersetshire, when the hailstones measured seven inches in circumference. Boston was visited by a dreadful one on the 15th of July, 1808, in consequence of which, and the abnormal rising of the tide, the town and country round was deluged. On the 10th of November, 1810, at Iffley, near Oxford, ten barns, some out-houses and thirteen large stacks of hay and grain were destroyed. (This damage seems to have been the result of a waterspout, as it was confined to one farm—a Captain Nowel's). On the 12th of October, of the same year, at Eaton Locon, Bedfordshire, a heavy storm of thunder, lightning and hail occurred, during which an immense ball of fire fell, and a barn, malting office and stable were burned down. On the 13th of October, 1813, a tremendous gale and storm prevailed all over Great Britain and Ireland, doing considerable damage in many places. For two days, December 16th and 17th, 1814, a violent thunder storm raged in London. A dreadful storm burst upon the town of Worchetz, in the county of Timeswrr, on the 2d of July, 1816, where out of two thousand six hundred buildings, none escaped injury. On the 13th of August, in the same year, a fearful storm raged on the English coast, in which much shipping was lost. Liverpool, Birmingham, Manchester, and other towns experienced a tremendous gale of wind on the 27th of February, 1818. Three hundred and fifty hurricanes were recorded on the Atlantic coast between the years 1493 and 1855. Many, of course, have occurred since the latter date. The hurricane of August, 1823, in which over one thousand vessels were lost, and that of October of the same year, as well as the fearful one of February, 1824, one fresh in the memory of the people. The years 1868–9, one of the periods of greatest sun-spot frequency, were fruitful of violent storms all over the world, particularly in the United States. In a revised list of all the hurricanes on the Atlantic coast, from the earliest historic date to November, 1873, published in the Paris *Comptes Rendus* for that month, is shown the comparison between the years of the greatest number, and most destructive hurricanes, and the years of the largest number of sun-spots. It is remarkably confirmatory of the theory now generally accepted: That the variations in solar heat produce a similar variation in the terrestrial evaporation, and an increased tendency to violent storms.

ZOOLOGY.

THE PEABODY MUSEUM, YALE COLLEGE.

The original gift by the late George Peabody was $150,000; of this sum $20,000 is to be entirely reserved until it amounts to at least $100,000, when it may be used for other parts of the whole edifice. A sum of $30,000 is also reserved to provide something toward an income for the maintenance and care of the Museum.

After $20,000 and $30,000 had been thus set aside from the fund, $100,000 remained for the erection of the present building, and that sum was invested with such judicious skill that its total was finally raised, in the course of about ten years, to $176,000. The executive officers of the board to whom this trust was confided, are Profs. J. D. Dana, G. J. Brush and O. C. Marsh.

The Peabody Museum is of brick, with stone trimmings. It is practically of five stories, since both the basement and attic are high and well lighted. The present structure consists of a main building and a wing; the roofs are lofty and pinnacled. In the design the building is not severely simple, yet it is not overloaded with ornament; in this particular, both as to details and general outline, the happy mean is struck. The architect is Mr. J. C. Cady of New York.

In the Peabody Museum no pains have been spared to put the exhibition on easy terms with the public, so that a person of fair average information passing attentively through the rooms, will be instructed as well as gratified by even a hasty survey. The collections are systematic, and they are arranged systematically. The first floor is devoted to mineralogy, except as to the space taken for a fine lecture room; the second floor to geology, including fossils; the third to osteology and general zoology; the fourth to archæology and ethnology.

Without intending any disrespect to the footprints, the precious stones, the mammoth, the six-horned dinoceras, or even the birds with teeth, the curiosity-seeker may for the moment pass them by and begin with the third story, where are the specimens of zoology, the life of the present day. Of course the subsequent proceedings will be somewhat undignified if the start is made at the top of the ladder, but the human race should be always the first to claim our sympathies. Since the proper study of mankind is man, it is well to begin here with the case nearest the door, labelled "Primates." There they stand in a row, in just the condition that Sydney Smith wished for in hot weather—with all the flesh removed from their bones. And now—how shall I state it tenderly without giving offence?—the Primates of science, unlike those of the Church, include, with man, the monkeys; and looking down the row of skeletons and skulls, it is not easy to say at a glance where man ends and ape begins. There are skulls with lofty foreheads

that look like the dome of thought, but unfortunately they belonged to chimpanzees; while other skulls, with low crowns and scarcely any forehead, once held the brains of some Indian chief or South Sea Islander. In this display of anatomy woman holds the place of honor, the finest of the skeletons of the human race being that called by the disrespectful attendants of the Museum, the "Chicago Girl." Her figure was tall and admirably proportioned, but the special interest which attaches to her skeleton is that she possessed an extra pair of ribs, or rather riblets, attached to the seventh cervical vertebra. Ordinary mortals are not thus provided with a spare rib; perhaps Adam was in his younger days. The "Chicago Girl" might have been an adept in dancing, for in both feet the bone on the inside of the elevation of the instep, which in ordinary skeletons is a single bone, with her is of two pieces, doubtless giving additional flexibility. Compared with this young lady, the bones of a Chinaman (21 years of age) standing alongside, show a feebler frame. From the well-known custom of the Chinese of carrying the corpses of their deceased countrymen back to the homes of their ancestors, skeletons of that race are among the most difficult to obtain: but the Museum is rich in Asiatic bones, and has one of the finest collections of Chinese and Japanese skulls in the world. It seems to be the general rule with the specimens throughout the Museum that each of them is rare, peculiar, or hard to match, and many of them are consequently of high value. Every known species of some of the rarer groups is here represented. Among them are the anthropoid apes, orangs, gorillas and chimpanzees old and young, and of each sex; and numerous brain casts, as well as skulls, that will afford food for thought not to the anatomist only, but also to the metaphysician. Other museums considered themselves enriched by a single skeleton or even a skull of a gorilla, and few are so fortunate; here there are half a dozen skeletons of that animal, and also many of its skulls; the other man-like apes are even more fully represented. But it is time to notice the systematic arrangement of the osteological specimens in this room; it is as follows:

Primates: including men, monkeys and lemurs.

Carnivora: including bears, hyenas, tigers, cats, dogs, etc.; also, the sea otter, wolverine, walrus, seal, etc.

Ungulates: divided into Artiodactyls or even-toed animals, such as goats and sheep, deer, antelopes, bovines, camels, various swine, etc.; Perissodactyls or odd-toed animals, such as the tapir, rhinoceros, and a complete series of the equine group; Proboscidians and Hyracoidea, a case where extremes meet, as the one sub-division includes the elephant and the other the hyrax or coney.

Rodents: such as rabbits, squirrels, beavers, and all kinds of rats and mice.

Cetaceans and Sirenians: such as the whale, porpoise, dolphin, manatee, dugong.

Edentates: such as the armadillo, ai, sloth, ant-eater.

Marsupials and Monotremata: such as the opossum, kangaroo, duck bill, (ornithorhynchus).

Birds: land, water and struthious; the last including the ostrich, emu, rhea, cassowary and apteryx.

Reptiles: crocodiles, lizards, snakes, turtles.

Batrachians: frogs, toads, salamanders.

Fishes: survivals of old forms, such as the gar-pike, amia, sturgeon; also the shark tribe and Teleosts or modern fishes.

Thus by a series of existing animals, none of the extinct races being here introduced, the student may see something of the relationships of structure all the way from fish to man. All the quarters of the earth have contributed to fill this series, and neither pains nor cost have been stinted to obtain the rarer types that complete the intervals. These specimens are peculiarly valuable to investigators who are tracing the order of descent of man. With this view, the case of Primates contains a series of pre-natal skeletons of the human species, which have already occupied a popular designation of the Museum as the "Infant Class;" and in general the younger forms of animals have been liberally provided, as these throw great light on the theory of descent from ancient types. The series of the existing horse family is fully presented; this is also true of the rhinoceros and of other groups. Of course such complete results throughout the range of Natural History have only been obtained by sharp and prompt competition with foreign museums, as to purchase; and also, by employing collectors in the ends of the earth and on every continent. There are so many curiosities worthy of separate mention that they cannot be even referred to here; but the visitor is not likely to miss the elephant's tusks cut so as to show where bullets had been imbedded and afterwards overgrown with ivory; a large elephant's skull sawn in two parts, showing how small a proportion of it was occupied by brains; or the "Baby Elephant," which was born in Barnum's menagerie; and it would be difficult to overlook the Rocky Mountain goats, old and young; or the gigantic salamander of Japan, which is fully a yard long. Several of the specimens, indeed, require more room than can be furnished under glass, and occupy the centre of the room—among these are the great walrus from Alaska, and some of the larger bones of a whale. Here two horse skeletons afford a remarkable contrast. One was the diminutive Shetland pony that spent the greater part of a long life in giving brief happiness to thousands of children at Barnum's exhibitions. The other illustrates the highest development of the horse, showing even in the skeleton the noble quality that was bred in the bone. This animal was the famous Arabian mare Esnea, imported along with Saida. When Mr. John W. Garrett, president of the Baltimore & Ohio Railroad, purchased her, he had to outbid Louis Napoleon. The Arab keeper, to whom she was accustomed in Syria, accompanied her to this country. She died a few months ago of a lung fever when 27 years old; her offspring are numbered at thirty-nine or forty. Mr. Garret very recently presented the skeleton to the Museum.

XUM

The whole osteological collection is three or four times larger than the portion displayed. It was in great part made by Prof. Marsh, and largely at his own expense, with a special view toward facilitating the comparison and study of fossil remains. Mr. George Bird Grinnell, who was with Prof. Marsh on some of his expeditions, and with Gen. Custer on the first entry of the Black Hills region, has been appointed by Yale College as Professor Marsh's assistant in osteology. Mr. Grinnell has rendered important services in arranging this collection, and it will remain under his immediate care.

The remainder of this room, as well as the rest of the third floor, is devoted to zoology. Of this department Prof. A. E. Verrill is curator. There is here a systematic collection of vertebrate animals, including fishes, presented in their external forms—some stuffed, some in alcohol. Here, as elsewhere in the building, the specimens are among the best or rarest of their kind, and those which illustrate the relations between separate groups of animals are especially to be found. Such, for instance, as the dipnoi or double-breathers among fishes, having both lungs and gill. These are represented by the lepidosiren and the ceradotus, the latter as far as the teeth are concerned, almost exactly similar to the ceradotus of the triassic epoch —a very distant one in geology. The fact that this animal has been found living in Australia, and that the changes in form of the teeth, if any, have not been important, is one of the most remarkable in modern discovery. The survival of its race through the long series of changes in the earth's crust since the trias, shows that whatever may have been the upheavals and subsidence of the earth in the great interval, no complete destruction of life throughout the globe has taken place. Even though the pre-glacial man should be discovered, the antiquity of the human race must be regarded as that of a day-fly compared with the ceratodus. On the top of the cases on this side of the room other strange fishes are mounted ; these are principally of the shark tribe.

The invertebrate life of the present day is also presented in the west room of this floor, in similar systematic arrangement. There is a good collection of insects, showing representative ones of each family, but with no attempt at exhibiting all the species. By such means the student is enabled to survey the whole field of entomology upon examining not more than a thousand insects—a bird's-eye view such as no bird has ever enjoyed. When a visitor from the prairies of the West begins to talk about grasshoppers, he is led up to view *Tropidacris dux* from Central America. This leader of the 'hoppers measures eight inches across the wings, and six and a half from tip of antenna to end of leg. The leaf-insects from India are admirable specimens of their kind ; they justify the forecastle yarn about the leaves dropping off the trees on one of the South Sea Islands and assembling in a swarm to share with shipwrecked sailors their breakfast on shore. Something ought to be said here concerning the ingenious boxes that contain the insects, the excellent arrangement of labels, and the like ; but in all such matters this Museum is beyond reproach. In another set of cases the crustaceans are displayed

to the utmost advantage. Each individual crab seems ready to walk the waters like a thing of life. Prof. S. I. Smith, who is an authority on the natural history of the crabs, has devised methods for showing off his pets with all their natural grace; they are evidently as ready as ring politicians to seize plunder with claws that will not relax till they are broken, or to back down on principle at a moment's notice. The pincher claw of what was probably the "boss" lobster is thirteen inches long by seven broad, and as formidably armed as an old-fashioned rat-trap. Consider what would have been the feelings of a bather if that pincher had closed on a tender extremity—say upon a great toe. Other strange creatures of the sea are in adjoining cases—star-fish bigger than Kentucky flapjacks, and probably as tough; anemones and hydroids preserved in glycerine, and expanded in nearly all their glory of wreath and color; polypes and jelly-fishes that have resigned life suddenly when dropped into picric acid; barnacles much larger than a goose egg, and of a shape to encourage the ancient belief that wild fowl might be hatched therefrom. Another of the old traditions of the sea, the story of the Kraken, which could throw out his long slimy arms around a vessel and drag it down beneath the waves, turns out to be true, since this very attempt was made upon a boat off the Newfoundland coast by an immense cuttle-fish; and here in the Peabody Museum are the arms of such a sea-monster, preserved in alcohol, and evidently not wanting in length or strength for such performance.

As representing the sea life of the New England coast the collection is quite complete, having rare and in many instances type specimens obtained in dredging expeditions by Profs. Verrill and S. I. Smith and the U. S. Fish Commission. Especially is the selection of fine specimens apparent in the corals and sponges, many being "uniques," that is, the only ones of their kind ever discovered. Both coasts of this country are here well represented, and the magnificent corals of the Wilkes Exploring Expedition contribute largely to the show. Prof. James D. Dana (the geologist), accompanied the expedition, collected many of the finest of these specimens, and wrote a standard work on that branch of zoology, Even the casual visitor cannot pass some of these great corals without a feeling of admiration for perfect development of form or color; such for instance as a meandrina (brain coral), exactly dome-shaped, and more than four feet in circumference, or the gorgona corals, having the form of miniature forest trees and rich in the highest tints of autumn foliage—varied combinations of red and yellow of every possible shade. To several of these an individual history is attached, well worth the telling, but space presses. When a visitor talks of the minute "coral insect" to Prof. Verrill, he is shown a gigantic one—a single animal eighteen and a half inches long and seven and a half wide—and reminded that the term 'insect" is a sad misnomer. The beautiful "glass sponges" are here in great variety, cornucopias of woven glass with lace fringes and lid, and showing the fibres at the base, by which they were once secured to the sea-bottom. There is here an elegant "Neptune's cup," which is 6½ feet in circumference

and $2\frac{1}{2}$ high—a goblet worthy of the Sea-God. Besides the general collection of marine animals, there are three separate collections which are special in their character. These are, one from the New England coast (already alluded to); one from the Pacific coast, complete, from Behring's to Magellan's Straits, and one equally complete from the coasts of our Southern States. In general it should be said that the completeness of the collections from the coasts of the United States is one of the most satisfactory features of this Museum.

Each of the floors has its own proper laboratory and working rooms, well appointed, and in constant use by the professors in the department to which the floor is appropriated.

From the creatures that are now existing on the globe to those that perished in by-gone geological epochs thousands of centuries ago, is in this Museum only a step to the lower story. The "vertebrate fossils" have a room to themselves, and even when the choicest of them are picked from Prof. Marsh's abundant collections, they will more than fill the space assigned. Already in the cases intended for mastodons and fossil elephants, the great bones of the Otisville mastodon have crowded out all else. The bones produce the impression of great size, and spectators view them with apparent awe. The enormous teeth and jaws are complete; the skull is $3\frac{2}{3}$ feet long; the great arch of the pelvis is 5 feet across, and still bears the mark—now historic—where an inquisitive countryman poked it with his cane, just to find out how hard the bones were. It is the best preserved mastodon yet discovered.

Ten years ago there was scarcely a specimen of existing or fossil vertebrates among the collection of Yale College—unless indeed some of her professors were themselves unconsciously shelved. To-day these collections, especially of the rarer forms, have no equal in the world. I see no other way to present the facts than to give full credit to Prof. O. C. Marsh, and state some of his discoveries in as few words as possible. His fossil horses—or rather animals of the horse family—from the $4\frac{1}{2}$ toed quadruped, no bigger than a fox, to fully developed and single-hoofed steeds not to be distinguished from those of the present day—illustrate the successive strata of the rocks from the lowest eocene epoch upward, by no less than forty species, all different, yet all indicative of the gradual development of the modern horse. Another series of animals forming the connecting links between reptiles and birds has been very largely illustrated by Prof. Marsh's labors. All the steps of this most important chain of development have not yet been ascertained, but the contributions to it from the fossils of the West that are in the Peabody Museum make the few other discoveries in this field of research comparatively insignificant. Of birds that existed in the Cretaceous epoch, there are, for instance, only two known (from fragments) in Europe; here there are the remains of not less than twenty distinct species, there being of each an average of about a dozen specimens. These include the wonderful birds with teeth, appropriately named the *Odontornithes*, which are now

divided into two orders, according as they have their teeth set in grooves or in distinct sockets. Of some of these the skeletons are almost complete as to individual birds; and Prof. Marsh is at present engaged upon a large and elaborate monograph on this subject, describing and illustrating the new forms by copious engraved drawings; one of the rooms on the second floor is at present occupied by the skilled assistants and draughtsmen engaged upon this important memoir. Another of the alliances between birds and reptiles, of which the birds with teeth supply such remarkable examples, is suggested by the pterodactyls, or flying lizards of the same cretaceous beds in Kansas. Prof. Marsh was the first to find any pterodactyls in America; these are of enormous size, the spread of their wings being from ten to twenty-five feet. The singular feature about these reptiles from American rocks is that they had no teeth, and hence in this respect they resemble the modern birds. The remains of other reptiles have been discovered in the cretaceous beds of the West, and the specimens here brought together include the bones of several thousand individuals. From these abundant remains Prof. Marsh has been able to determine many doubtful points, such for instance as that the mosasaurs had hind limbs or paddles, and that they were covered, at least in part, with hard, bony scales. The mosasaurs were sea-serpents, from ten to sixty feet in length. Bosides these, there are here also the remains of gigantic crocodiles, lizards, turtles and snakes, any one group of which would make the reputation of an ordinary museum. Of the enormous reptiles of geology, none yet known surpassed in size one which Prof. Marsh has recently described. Its remains were found in the cretaceous beds of Colorado; it is named *Titanosaurus montanus;* it was herbivorous, and attained a length of fifty to sixty feet. Believers in a vegetarian diet should take note of these facts, as that saurian was the largest land animal known to have existed on this planet. The reptile will also supply a bone to pick, that will puzzle people who have assumed that animal life in this hemisphere has been in general represented by smaller forms than the corresponding ones of other continents. If the question of size should ever be raised as to the mammals of the West, the Peabody Museum can show the remains of more than one hundred distinct individuals of the dinoceras kind —a new order of mammals from the Eocene of the Rocky Mountains, nearly equal to the elephant in point of size, and armed with four to six horns, as well as formidable tusks; or point to the brontotherium of the miocene rocks —a creature as large as the dinoceras, and also armed with horns. The oldest known member of the rhinoceros family, perhaps its progenitor, has been discovered by Prof. Marsh in the upper eocene of Utah. From the lower beds of the same formation in Wyoming Territory came the tillodonts, perhaps the strangest of all Eocene mammals, as they seem to combine characteristics of the carnivora, rodents, and ungulates. There, also, the same discoverer first found the North American monkeys, which are allied on the one side to the lemurs of the Eastern Hemisphere, and on the other to the monkeys of South America.

The list of these discoveries could be greatly extended, but even a mere catalogue of the novelties would be much too long for this letter, since it would include more than 300 animals new to science, about 200 of which Prof. Marsh has already described in technical publications. In general, it may be stated, that a very large number and variety of animal forms are here collected which enable men of science to trace the connection between the strange creatures of early geological eras and the animals that are living to-day. The changes of form which constitute the life history of the earth are displayed by these fossils in the order in which they actually took place. Until these specimens were found and their characters determined, the story of the development of our existing animals could only have been surmised; no Old World fossil remains supplied the deficiencies of the series, and indeed the evidence was far from conclusive that the change from one form of animal life to another took place in Europe. At all events, these fossils of the West demonstrate beyond a reasonable doubt, concerning certain groups, as to when, where, and how the change did actually occur. In that respect this collection of "fossil vertebrates" is absolutely unrivaled. It also contains, however, a considerable number of European fossils that are of the rarer kinds, or have some specialty that makes them valuable, such as the famous Eichstadt pterodactyl that Professor Marsh secured by a cable dispatch, and by paying a sum of money which (as Prof. Agassiz himself said to me) had the effect of raising the price of fossils throughout Europe. In the lithographic stone that holds the pterodactyl's remains, there appears the impression of the stretched membranes that served the animal as wings, like those of the bat. But there is not room here to go into these interesting details. The arrangement of the cases is somewhat similar to that of the osteological display; their fossil contents, when the specimens are all placed, will be somewhat as follows: Primates (chiefly monkeys and lemurs); Mastodon, Mammoth; Dinocerata, Brontotheridæ; Perissodactyls (horse and rhinoceros families, etc.); Artiodactyls (camel, pig, deer families, etc.); Carnivora; Tillodontia; Bats, Rodents, Marsupials, etc.; Turtles; Dinosaurs; Mosasaurs; Plesiosaurs, Ichthyosaurs; Crocodiles, Lizards, etc.; Fossil Fishes; Pterodactyls and Pteranodons; Cretaceous Birds; (*Hesperornis*, *Ichthyornis*, etc.); Tertiary and Post-tertiary Birds. The last-mentioned division may include extinct birds of the present epoch, which are here represented by about a dozen skeletons of the dinornis or moa (being a much more complete series than is owned by any other museum, with the possible exceptions of that in the British Museum and one in New Zealand); several skeletons of the great auk, and various remains of the dodo. The perfect skeleton of the gigantic Irish elk, as the animal is extinct, will probably find place in this room; but certainly none of the cases can contain this fine specimen, since the spread of its antlers is thirteen feet and two inches.—*N. Y. Tribune.*

ASTRONOMY.

DISCOVERY OF SATELLITES OF MARS.

Professor Asaph Hall, of the Washington Observatory, has recently announced the interesting discovery of two satellites attendant upon the planet Mars. At about eleven o'clock on the night of August 16, Professor Hall, by the aid of the great 26-inch refractory telescope, noticed a very small star following Mars by a few seconds. Two hours later he looked again and to his surprise found that the distance between planet and star had not increased, although the former was moving at the rate of fifteen seconds per hour. Hardly crediting his discovery, Mr. Hall delayed further observation until he could bring the matter before his colleague, Professor Newcomb, and that astronomer, being confident that the discovery of a satellite had been made, calculated roughly its time of revolution, which he found to be one day and eight hours. This enabled the prediction of the probable place on the following night—a prediction which was verified. On the morning of August 17 another satellite appeared, and its identity was fully recognized.

The distance of the first satellite from the planet is between 15,000 and 16,000 miles, which is less than that of any other known satellite from its primary, and only about one-sixteenth the distance of the moon from the earth. It is exceedingly small, having a diameter of not over 100 miles. The inner satellite is believed to be still closer to the planet, and to have a period of less than eight hours. The first moon is distant eighty, the second thirty seconds from their primary. Further and more accurate details will, however, soon be forthcoming, as probably the keen eyes of astronomers the world over will now be turned upon Mars. Next to our moon, more full and accurate knowledge is possessed regarding Mars than of any other heavenly body. Venus is nearer to the earth, but when most closely approximated she is invisible, being concealed by the solar light. Mars, however, may be examined under favorable circumstances, and during the present year the conditions are especially advantageous, owing to the planet being in opposition to the sun, near perihelion. The apparent disk is now larger in the proportion of three to one than when the planet is in aphelion, while the illumination is more brilliant in the proportion of three to two. At the same time the planet is nearer perihelion than previously for more than thirty years; so that in the heavens its brightness is but little inferior to Jupiter.

While the surface of Mars has been mapped with remarkable accuracy, and although probably no other planet has been subjected to more keen and continuous scrutiny, yet up to the present time all searches for satellites attendant upon it have been fruitless. Most astronomers have not hesitated

to assert that none such existed, though it has been said that if Mars has moons they are too small to be recognized by any telescope extant; but in any event the probable presence of Martial moons was not to be predicated on any phenomenon exhibited by the planet itself, and if their existence was suspected it was because it would be more in accordance with the nebular hypothesis that they should be present than absent. In a work on astronomy published some forty years ago, we find mention of a phenomenon on Mars which might possibly lead to the idea that the planet was subjected to reflected light from some near body, and that was, that a curious and persistent illumination of the planet had been noticed, which, under the circumstances, was unaccountable, save under the hypothesis that the planet was slightly phosphorescent.

The discovery is a triumph both for Professor Hall and for Mr. Alvan Clarke, the maker of the great telescope. It, besides, shows what may be expected of the still more colossal instrument which at no very distant day we hope to see established in the Lick Observatory.—*Scientific American.*

HYGIENE.

HOBBIES IN DENTISTRY.

BY A. H. TREGO, D. D. S.

It is fair to estimate that no comparatively new science has been developed more rapidly than dentistry in the last quarter of a century. It is not surprising, then, where there are so many self-taught and untaught disciples, that there is a field full of "hobbies" and many poor riders.

One of the most dangerous of these hacknies is the "mallet" for impacting gold in cavities of teeth. An endless variety has been introduced, but none that affords general satisfaction. The more skilled and unbiased operators have found the mallet system to be "more or less imperfect and impracticable, and dangerous in the hands of injudicious operators." One objection is that no mallet has been produced that will strike a "back-action blow." Secondly, it is physically impossible for any "tapper" to know exactly when and how hard to strike; just as it is impossible for one person's muscle to vibrate in unison with another's brain and eye. The danger is that a succession of blows, sufficiently hard to weld gold, is certain to produce congestion of the periodontium.

Disciples of the mallet claim that "taps" are less painful and injurious than "hand pressure concussion." Patients who have tried both most emphatically disagree with them, and practice proves that very many teeth are ruined by the use of mallets. To illustrate, one may apply the full strength of the arm in pushing against another's head and not force him

over or produce pain; whereas a slight blow from the fist will knock him down and produce severe pain and congestion.

It is a mistaken idea that gold foil cannot be welded and made sufficiently solid without hammering. It is an established fact that an expert hand-pressure filler will get more gold into a cavity, and do it quicker and better—more evenly condensed, than is ever done by mallet. The most accomplished demonstrators of operative dentistry recognize this as a business fact, and do not consider a student competent to graduate unless he can condense gold perfectly by means of the "vibratory concussion" of hand pressure. Many persons never can accomplish this peculiar grip of hand; hence the indiscriminate and extensive adoption of the "sledge-hammer." A good automatic plugger is indispensable as an assistant to hand-filling, but it requires to be skillfully manipulated—and judiciously let alone.

All new inventions deserve fair trial, and genuine improvements adoption; but in matters as important as the preservation of one's teeth, skill and science should be preferred to "main strength and awkwardness." Electroplating or amalgam of gold (dodecahedrons) is not impossible as the acme of the great desideratum.

Hobby No. 2 is the very prevalent practice of disfiguring teeth by separating or cutting away for the purpose of facilitating filling approximal cavities. In a majority of cases it is not only useless but absolute malpractice. The supposition is that the Creator knew better than any dentist the proper shape for human teeth.

The fashion of extending gold fillings beyond the natural contour of the tooth, showing an unnecessary amount of gold, displays a want of taste and judgment on the operator's part, and a deficiency of refinement on the part of the patient equivalent to the snobbery of wearing superfluous jewelry.

"Rubber Dam" is a hobby that has carried numerous riders far beyond reason and common sense. The dam is a valuable acquisition, but it is used entirely too much. Many use it desiring to have it inferred that they are "up to latest improvements;" and where expert operators would do better without it and avoid pain and annoyance to the patient. The clamps and ligatures employed to hold the dam, and the force required to get them into position, frequently produce peridontitis and permanent injury to the teeth and gums.

Some claim that moisture should be excluded from the cavity while excavating; that the dentine absorbs saliva and renders it liable to decay after being filled. This is an absurb idea; the dentine is as thoroughly saturated while the decay is in the cavity as it is possible to make it, and there is no difficulty in making it perfectly dry when ready to fill. On the other hand, the caries and albumen, when drilled or scraped, form a glutinous paste which can only be removed by frequently syringing the cavity with tepid water; in which case the dam is worse than a nuisance. It is a fal-

XUM

lacy that the dam is necessary to prevent the patient's breath moistening the gold, thereby preventing cohesion. The gold is more liable to be soiled from other causes; as for instance, the operator's breath, sultry atmosphere, coal gas, carbonic acid gas, smoke from the annealing lamp, and sulphurous fumes from the rubber.

I use the dam only when obliged to, and have no difficulty, in a majority of cases, in keeping the cavity perfectly dry by means of napkins and other simple and unannoying appliances. I filled teeth twenty-five years ago with "soft gold," by means of smooth instruments, that are in perfect condition to-day, and I have no hesitation in asserting that the "rubber dam" and "mallet" are used seven times in ten to the disadvantage of both patient and operator.

TECHNOLOGY.

ARCHITECTURAL SCIENCE TEACHING.

ELEMENTARY CLASS.

QUESTION.—*Describe different materials used by painters. Describe ingredients of color.*—The materials used by painters are paints, oils, driers, stains, varnishes, etc. Colors or paints may be divided into five classes, according to their principal ingredients. Lead paints, most commonly used, have white lead or carbonate of lead as a basis. This material is ground up in oil in a stiff paste. Linseed oil, with litharge or other driers, and sometimes turpentine, are added to it to form the paint ready for use. The required tint is obtained by adding to this the proper coloring pigment. The exact proportion of ingredients is regulated by the nature of the work, climate, etc. Red lead enters into the composition of the priming coat because it is a good "drier" and sets "hard." Linseed oil is used as a medium for applying the paint; it fills up the wood pores, and acts as a preservative. Turpentine makes the paint easier to work, and more liquid, but it plays no part in the preservation of the wood, as the greater part evaporates. Driers are mediums to cause the contained oil to dry and set quickly. Various materials are used, as litharge, sugar of lead, etc. Zinc paints have zinc oxide as a basis. Silicate paints are manufactured from almost pure silica, which is not acted upon by any metal or acid—in fact is almost indestructible. This kind possesses the advantages of great durability, has no galvanic action when applied to iron, as in the case of lead paint, and does not tarnish by the action of gases. Colors are made same as the lead paints, and are mixed in the same way. Oxide of iron paint acts as a good preservative for iron-work. Bituminous paints are used for a similar purpose, and for rough carpentry. Stains are mixtures used to darken wood to the color of the imitated wood. Varnishes are of various kinds—copal, etc.—and are used to preserve the paint, and give a gloss to the finishing coat.

QUESTION.—*Describe the process of common painting wood and ironwork.*—Woodwork is prepared for painting by brushing over all resinous knots with a thin coating of knotting (a compound of shellac dissolved in naptha), or gold size, to confine the resin, and prevent it running under the paint. The priming is then laid on, any plain color, well worked into the pores of the wood, with and across the grain; when this is dry, the stopping is done. All nail and brad holes, etc., must be well filled up with putty, and lightly rubbed over with glass paper. The second and following coats are applied with more care, brushed with the grain, and the work covered equally well everywhere, showing no tool marks or running edges. If the last coat is to be light, the second and third should be similar in color, and if it is to be finished dark, dark color must be used for the previous coat. Ironwork should be cleared free of all rust, oil, or grease before painting. A good first coat is color made up with red lead; the other coats may be similar to that used for wood. Iron being almost non-absorbent, three coats are sufficient for new work, unless in very exposed situations, and for the same reason, care must be taken, especially in ornamental work, not to fill up the fine lines of leaf-work, etc., by using too much paint, as the character of the work would thereby be injured. It is not so much a thick coat as a thorough one that is the best protection.

QUESTION.—*In coloring walls what precautions should be used?*—The walls should be thoroughly dry. In coloring walls the coats should be carefully laid on and smoothly, each coat being rubbed slightly with sand paper before applying the next. The "flatting" or finishing coat should be made a few shades lighter than the pattern, as it darkens in drying. Japanner's gold size, if used, should be applied quickly, as the turpentine evaporates quickly, leaving an indelible glossy surface. A certain time should be allowed between the coats, the drying of the same depending upon the quantity of driers used, the weather, and temperature of the apartment. To expedite the work, new walls are generally "distempered" when not dry enough to receive the permanent decorations. Distempering is a kind of painting with color prepared with size or some other glutinous substance. In distempering, the walls must be dry and free from damp; if not, at the completion will be shown all the defects. Two or three coats should be applied, in order to obtain an even color.

ADVANCED CLASS.

QUESTION.—*Explain the theory of coloring.*—The accepted theory is that there are certain colors that cannot be produced by any combination of other colors. They are termed primaries, because all other colors can be obtained by mixing them in certain proportions. The primary colors are red, blue and yellow. Some authorities substitute green for yellow. Secondary colors are derived from mixtures of the primary colors in pairs—as violet from red and blue, orange from red and yellow, and green from yellow and blue. Tertiary colors are produced from secondaries—as citron from orange and green, etc. White and black are usually considered neutrals. To secure

"harmony of colors" they must be equalized to the varying proportions shown in the solar spectrum—the three primaries being used either in their purity or compounded. The eye being constructed to see white light, when looking on a colored surface, it is best pleased by a contrast. Contrasting colors to harmonize should be mutual complementaries of each other—making up the full complement of colors contained in the solar rays. The complement of any primary—say, red—will be the secondary compounded from the other two primaries—as green from blue and yellow—red will thus harmonize with green, blue with orange and yellow with violet. The best proportion for mixing primaries, so as to harmonize, is: red, 5; blue, 8; and yellow, 3. The latter is the most vivid, and should obtain a prominent position. Blue is least vivid and retiring, and should be kept in the background—red to be used as an intermediate color.

QUESTION.—*Describe the proper mode of painting wall surfaces.*—To paint wall surfaces properly often five coats are necessary; but if the plaster be not very absorbent four will be sufficient. If the work is required without gloss the last coat is mixed with turpentine only, which is called flatting; if the work be not flatted the finishing coat is two of turpentine to one of oil. For the priming coat boiled oil should be used, then the three coats of white lead and oil, or more if required; generally the first coats should be some shades darker than the finishing coat. The proper drier to be used for walls is sugar of lead, and in painting wall surfaces great care should be used in selecting the very best quality of oils and white lead—the older the oil the better.

QUESTION.—*What is the best paint for ironwork?*—The best paint for ironwork is either the oxide of iron paint, known as the Torbay paint, or the silicate oxide paint, both consisting of oxide of iron and silicious matter, to which any color may be added and applied in the usual way. They can be applied even after the surface has commenced to rust, as from their nature they amalgamate freely with the rust, forming an impervious coating adhering well to the surface, and yet sufficiently elastic to prevent cracking when the iron expands or contracts under variations of temperature. Bituminous or tar mixtures, thinned with linseed oil, are well adapted for ironwork, especially when they can be applied hot, or to the heated surface of the metal, so as to insure a firm adhesion by entering the pores. A mixture of silicate oxide with tar also forms a good durable coating on iron. When ironwork is to be painted with ordinary lead paint red lead should be used. The adhesion of such a coating on ironwork can seldom be depended on in consequence of the non-porous surface. This is further prevented by the galvanic action that sets in between the iron and lead. Galvanizing, or coating the surface with a preparation of zinc, is also frequently resorted to as a preservative. With all such coatings the surface must be perfectly clean and free from rust. It is advisable, so as to prevent rusting, that all ironwork should be coated with some preservative soon after it leaves the mould, forge or mill.—*Building News.*

PHYSIOLOGY.

CURIOSITIES OF THE VOICE.

Some years ago, a delightfully interesting book was written by Sir Chas. Bell, on "The Human Hand." There might be fully as interesting a work written on the mechanism of the human voice, in which would be equally demonstrated the power, wisdom and goodness of the Creator. We offer a few observations on the subject. Until recently there were mysteries difficult to explain concerning the wonderful inflections in the voice. Now, it is thoroughly understood how words are produced, and how the throat is able to send forth a wide variety of charming notes in singing. We begin by mentioning that Dr. Mandl has devoted himself to the study of the organs of speech, and from his work on "The Larynx" we give some interesting particulars. Investigators have long been occupied with researches; but, until they had seen the larynx of a living being, one thing only was proved—that the voice was formed in the glottis. For fifty years of this century they were trying by mirrors and other appliances to examine the interior of this organ, but without results. Suddenly an inspiration came into the head of a celebrated singer, whose name awakens charming remembrances among old amateurs. This was M. Manuel Garcia. Ignorant of all the trouble which surgeons had taken in order to observe the movements of the throat in the act of singing, he conceived the idea of looking at himself. By the help of two mirrors, the one reflecting the image on the other, he saw the whole of his larynx depicted. In ecstacy before the glass, he determined to pursue the accidental discovery which had been so long dreamed of. But the autumn had set in, and the sun's rays, which were necessary to success, did not lend their aid. London with its fogs forced him to try artificial light, the results of which were unsuccessful, and therefore he could only profit by fine days; yet he soon recognized how isolated sounds were produced. In 1855 the Royal Society received some communication from him on these curious studies.

The subject was at once taken up with great activity, especially in Vienna, where success was far from equaling the hopes of the doctors. The caprices of solar light and the defects of artificial threw them into a state of despair. By all means they must improve their mirrors. Czermak, the Professor of Physiology at Pesth, taking an example from the instrument used in examining the eye, the ophthalmoscope, had recourse to a concave mirror which concentrated the light. From this time there was no difficulty but to perfect the lenses. Czermak, having acquired great skill in the use of his laryngoscope, visited the principal cities of Germany, where his demonstrations deeply interested surgeons and physiologists. He was warmly received in Paris in 1860, where he showed not only the whole length of his larynx, but also the interior of the trachea or windpipe as far

as its bifurcation; a spectacle truly astonishing to those who witness it for the first time. It is not possible to examine the organ of the voice with the same facility in all; a man must have had some experience before he can do it.

A slight sketch of this organ will perhaps make the subject clearer. From the breast there rises to the middle of the neck the passage for the air between the lungs and the mouth; at one end it is divided into numerous branches, called the bronchial tubes, at the upper end, like the capital of a column, is seen the larynx, resembling an angular box; strong cartilages make it very resistent; and the interior is lined with a mucous membrane forming folds, named the vocal lips. These separate, lengthen, or shorten, in the formation of various sounds. The largest of the four cartilages rises in an annular form, and protects the whole structure. It is but slightly shown in the neck of the female, but strongly marked in the man, and is popularly called Adam's apple. Like everything else, the larynx presents individual differences; a fine development is an indication of a powerful voice; as the child grows up there is a sudden alteration and increase of size; but it always remains smaller in the woman than in the man; the angles are less sharp, the muscles weaker, the cartilages thinner and more supple, which accounts for the sharp, treble notes in their voices.

Singing demands a different kind of activity in the organs from speaking. In society, where education requires a submission to rule, singing belongs to the domain of art; but, in a primitive state, all nations have their songs. Musical rythm drives away weariness, lessens fatigue, detaches the mind from the painful realities of life, and braces up the courage to meet danger. Soldiers march to their war-songs; the laborer rests, listening to a joyous carol. In the solitary chamber the needle-woman accompanies her work with some love-ditty; and in divine worship the heart is raised above earthly things by the solemn chant.

A strong physical constitution, and a perfect regularity in the functions of the organs used in singing, are inappreciable advantages. They should be capable of rendering an inspiration short and easy, the expiration slow and prolonged; there is a struggle between retaining and releasing the air, and with the well-endowed *artiste* the larynx preserves its position, notwithstanding the great variety of sounds which it emits. But the evolutions of the parts are multiplied, the vocal lips vibrate, and the configuration of the cavity modifies the sounds which are formed in the glottis, and determine the tone of voice. The most energetic efforts of the will cannot change this tone in any sensible manner. Professors injure their pupils by prescribing the position of the mouth, from which perhaps they themselves derive an advantage.

It is interesting to watch the play of the organs by the help of the laryngoscope, and see the changes which succeed one another in the low and high notes. At the moment when the sound issues, the glottis is exactly closed; then the orifice becomes a very long figure, pointed at the two ex-

tremities. As the sound rises, the vocal lips approach each other, and seem to divide the orifice into two parts; then as the highest notes are sounded, there is but a slit the width of a line. The vocal lips change like the glottis; they stretch out, harden, thicken, and vibrate more and more as the voice rises. Women, who have a smaller larynx, and shorter vocal lips can sing higher notes than men, with a tone less powerful, but sweeter, more uniform, and melodious.

The ordinary limits of the voice comprehend about two octaves of the musical scale; it can easily be increased to two and a half; but some reach the very exceptional range of three, and three and a half. Thus, at the commencement of this century, Catalani astonished every one who heard her, as a sort of prodigy. Suppleness and intensity may be acquired by practice, as has been proved in the case of many singers: the voice of Marie Garcia was harsh, but it became at last the delicious one of Madame Malibran. In general, the natural gift is manifested without culture; the child endowed with this great charm warbles like a bird for amusement; a lover of art passes by, listens with surprise, and promises glory and fortune to the rival of the lark. Thus the famous Rubini won his triumphs. Occasionally the singer has in a moment lost all power, and an enchanting voice will disappear never to return; such a misfortune befell Cornelia Falcon.

Those who have watched the formation of vowels and consonants, can describe very precisely the positions which the lips, tongue, and palate take in articulation. Yet almost identical sounds can be produced with different positions. As we all know, the teeth are a great help to pronunciation, but a person who has lost all his teeth can modify the play of the lips and tongue and express himself intelligibly. Actors imitate the voice of public characters so as to make the illusion complete. The ventriloquist can make his voice issue as if from a cavern. When misfortune has deprived a man of the whole or part of his tongue, he can still hold a conversation, though the sounds are never particularly agreeable. All this shows that there is nothing absolute in the actions which form words, though in general the same organs play similar parts. Those who were born deaf have ceased to be dumb by interpreting the movements of the mouth with wonderful certainty; they guess the words of the speaker instead of hearing them, and so learn to speak by imitation, their speaking, however, being seldom well modulated. There are now several institutions where the poor creatures who have been deprived of one of their senses can acquire a means of communicating with their companions without the tedious intervention of writing. The master indicates to the child how he must open his mouth, place his tongue and lips; he then draws the pupil's hand over his own larynx, so that he may feel the movement. Those who, like the writer, have seen this reading from the lips, will be struck with the surprising delicacy of the impression made on the eye which has been thus cultivated.

XUM

In comparison with the human voice, that of animals seems poor indeed. The barking of the dog, the mewing of the cat, the bleating of the sheep, cannot be called language, in the proper sense. Yet the larynx of these creatures is on the same plan as that of man. Among monkeys the resemblance is perfect. To all appearance the impossibility of speaking is due to the formation of the lips and tongue. In 1715 Leibnitz announced to the French Academy that he had met with a common peasant's dog that could repeat thirty words after its master. In spite of such an authority, we must always say when we most admire the intelligence of this faithful companion, "He only wants words." So well endowed with memory, affection, and intelligence, he can only express his joy by sharp, short expirations of air through the glottis. Howling is a prolonged note in the pharynx, excited by deep grief or pain. Yet they in common with many other animals can communicate with each other in a marvelous manner when they wish to organize an expedition. A dead bullock was lying in a waste, far from all habitations, when a solitary dog, attracted by the smell, came and fed upon it; immediately he returned to the village and called together his acquaintances. In less than one hour the bones were picked clean by the troop.

Opportunities for studying the language of wild animals are rare; they fly from man, and when in captivity they become nearly silent, only uttering a few cries or murmurs. Travelers have sometimes been able to watch the graceful movements of the smaller African apes. Living in the branches of trees, they descend with great prudence. An old male, who is the chief, climbs to the top and looks all around; if satisfied, he utters guttural sounds to tranquillize his band; but, if he perceive danger, there is a special cry, an advertisement which does not deceive, and immediately they all disperse. On one occasion a naturalist watched a solitary monkey as he discovered an orange-tree laden with fruit. Without returning, he uttered short cries; his companions understood the signal, and in a moment they were collected under the tree, only too happy to share its beautiful fruit. Some kinds possess a curious appendage, a sort of aërial pouch, which opens into the interior of the larynx and makes a tremendous sound. These howling apes, also called Stentors, inhabit the deepest forests of the New World; and their cries, according to Humboldt, may be heard at the distance of one or two miles.

If it be ever possible to observe the play of the larynx of animals during the emission of sounds, the subject will be a curious one. The difficulty seems almost insurmountable, as their good-will must be enlisted; yet M. Mandl, full of confidence in his use of the laryngoscope, does not despair. After man, among animated Nature, the birds occupy the highest rank in Nature's concerts; they make the woods, the gardens, and the fields, resound with their merry warbles. Cuvier discovered the exact place from which their note issues. They possess a double larynx, the one creating the sounds, the other resounding them: naturalists call the apparatus a drum.

Thus two lips form the vocal cords, which are stretched or relaxed by a very complicated action of the muscles. This accounts for the immense variety of sounds among birds, replying to the diversity in the structure of the larynx.

The greater number of small birds have cries of joy or fear, appeals for help, cries of war. All these explosions of voice borrow the sounds of vowels and consonants, and show how easy and natural is articulation among them. Those species which are distinguished as song-birds have a very complicated vocal apparatus. For the quality of tone, power, brilliancy, and sweetnes, the nightingale stands unrivaled; yet it does not acquire this talent without long practice, the young ones being generally mediocre. The parrots which live in large numbers under the brightest suns, have a love for chattering which captivity does not lessen. Attentive to every voice and noise, they imitate them with extraordinary facility; and the phenomenon of their articulating words is still unexplained. It is supposed that there is a peculiar activity in the upper larynx. As a rule, they attach no meaning to what they say; but there are exceptions. When very intelligent and well instructed, these birds—such as M. Truefitt's late parrot, an account of which appeared in this *Journal* in 1874—can give a suitable answer to certain questions.

Our notes on this interesting study come to a close. Man is well served by his voice: words are the necessity of every-day life; singing is its pleaure and recreation, whether the performers are human beings or birds—*Chamber's Journal*.

SCIENTIFIC EDUCATION.

COMMENCEMENT ADDRESS, BY ALFRED P. BOLLER, C. E.,

To Graduating Class of '77 at Rensselaer Polytechnic Institute.

Once more, in the sequence of events, the season of the year has arrived when the higher educational institutions throughout the land are all aglow with the excitement of "commencement day," while fathers and mothers await the hour, with proud satisaction, when the coveted parchment, certifying to all manner of learning, will have been formally bestowed upon their representatives in the rising generation. Thenceforth, the diploma becomes a family heirloom, to be carefully stowed away in its japanned tin case among the family archives, or perchance hung upon the wall of the family sitting-room in a handsome frame, a daily reminder of what "our boy" has accomplished. Amid all the changes that have taken place in our educational systems, the practice of a public introduction to the world, of the completed product of such schools as confer degrees, is one that even the most radical

iconoclast has not attacked. The commencement season is no meaningless formality, but an important epoch in the life of each generation as it passes along. It is at once the beginning and ending of a never-to-be-forgotten period of one's life. From the controlling influence of home and the instructor, the young man steps at this season into the arena of wordly strife, and thenceforth must bear the responsibilities of his own actions. Further than this, every graduating class adds just so many units to the world's educated intellectual forces, out of the clashing of which are evolved those ideas upon which the progress of humanity depends. Commencement day is therefore not alone a time of public congratulation for the honorable completion of a task, but a solemn occasion to signal the entering upon a new life of a class of young men, to whom is given a very important part to play in their country's development. As such it will always have an interest for society, the members of which will gather on all commencement occasions, year after year, as they have always done, not only paying a cheerful tribute to intellectual success, but also warmed up by that great under-current of human sympathy, that makes life worth the living. Like the wedding day, commencement day will never lose its interest for society, but will stand as long as the school and college from the basis of our social well being. The laudable ambition to excel in educational advantages, has in recent years taken a firm hold of the American people, and countless schools and colleges have been established all over the Union. While some are the outgrowth of a pardonable vanity on the part of a wealthy donor ambitious to perpetuate his name in a community out of which he sprung, the greater portion have been created in response to a demand for knowledge among the masses, impelled as it were by the exactions of increasing culture. Taking them altogether, they are evidence of a nation's effort toward intellectual advancement, and are a standing rebuke to those pessimists who love to dwell mournfully on the "degeneracy of the times." It is a matter of regret that so many of these newer colleges are weaklings, anticipating by years the capacity of the community in which they are situated to properly support. While giving every credit to the motives which founded them, they are costly evidences of the unwisdom, with which men of wealth, ambitious to serve the cause of education, often discharge their self-imposed stewardships. Had the same amount of wealth that has been scattered throughout the country in numberless higher class schools and colleges, that for years must have a struggle for existence, been concentrated in well established educational centres, the benefit to the cause of sound learning, would necessarily have been very great, and it is to be hoped that future donors will add their benefactions to existing schools, rather than increase their number. The educational period through which we are passing, is in marked contrast to that which gave character to the generation now fading out of sight. This contrast is sharply drawn, and it will be in harmony with this evening's celebration, to ask your attention to some of the leading features of the "new education"—what it has done for society, and what course its future development will probably

take. In the first place it is to be remarked, that educational systems are not determined by purely human inspiration, but rather the result of certain social conditions, forming the soil, as it were, out of which grows that system which it is best capable of nourishing. The "*Novum Organum*" could no more have been a product of a barbarous society, than the rose a product of the desert. In all social movements it is impossible to determine the exact line of demarcation between two radically different systems, so imperceptibly does one merge into the other. We know when a change is complete, and we are struck by the contrast with that which it has displaced, but the ending of one, and the beginning of the other, cannot be defined. As in all things the new never displaces the old without a struggle, so the ideas of the new education have not won their well nigh universal acceptance without vigorous opposition from the old regime of school men. It is the story over again in a different shape of the "Revival of the Arts and Sciences" in the fifteenth century, when the supporters of the scholastic wisdom of the middle ages had to yield to the progressive culture of a newer school. That contention history has handed down to us as the struggle between the obscurantists and the humanists, apt terms, tersely embodying the distinct qualities of each. The obscurantists of our day, what few of them are left, are represented by those who would base educational systems upon transmitted opinions, on metaphysics and the literature of bygone ages. With such nature is held up to the test of authority, and in case of disagreement, so much the worse for nature. On the other hand our modern humanists repudiate authority as such, regard society and civilization as a development, and test all ideas and asserted truths, in the crucible of natural law and order. While the germs of the new system can be traced back through centuries, in a fitful sort of a way, it was not until the close of the sixteenth century, when Francis Bacon, whom Pope pronounces the "wisest" and "best" of mankind, despite his moral infirmities, gave to the world a system of logic, at once so profound, complete and penetrating that it marks an intellectual epoch, and formed the solid foundation of modern processes of reasoning. He expressed his disgust at the school methods then in vogue in these words: "They learn nothing at the universities but to believe. They are like a becalmed ship, they never move but by the wind of other men's breath, and have no oars of their own to steer withal." They whole key of Bacon's teachings is embodied in the idea that all learning, all knowledge should have but one object —"the good of humanity." He held that study instead of employing itself on wearisome and sterile speculations, should be engaged in mastering the secrets of nature and life, and applying them to human use. Instead of hypotheses, he called for facts, and he showed that the only road to truth was by proceeding from effect to cause, thus utterly reversing the customary methods of mental training and culture. It so happened that the intellectual soil succeeding Bacon's time was ripe for just such seed, which has grown and expanded into a tree bearing fruit of abundant promise. The growth was slow at first, but the dropping of its blossoms from time to time

XUM

rapidly reinvigorated the soil in which it had taken root, and to-day we see its overshadowing branches extending throughout all civilized nations. The tangible fruit of this "tree of knowledge" is *science*, the true meaning of which term it is important for us to bear in mind. As formerly used, it was applied to those branches termed physical, and there are those who have no higher conception of its meaning. In the present and developing order of things, it has a much broader signification, and refers more to a certain method of investigation than to specific subjects. Its scope embraces all fields of human research that are capable of being brought under general laws, based upon observed facts. Science aims to bring "thought in harmony with things," and whatever subject is traceable from effect to cause, by inductive processes, is a legitimate field for scientific investigation, be it religious, social, political or physical. The growing demand, on the part of the intelligent masses, for popularized science is due to the recent appreciation of this very broadened view of the meaning of science. So long as science was confined to the investigations of certain branches of purely physical interest, and taught as was done at our universities a quarter of a century ago, popular interest in it was rather of a sentimental kind. Science, however, when applied to higher problems, such as life, politics or religion, comes home to the thinking individual with a transcendent power, and creates in him a very craving to know to what hitherto hidden Arcana he is being conducted. As applied to education, the scientific method of investigation, as a system, is comparatively modern, and was the natural consequence of the discovery of the successful application of steam to practical uses, the opening era of the most stupendous advancement in things material, intellectual and moral, that the world has ever seen. None other could exist in a soil so prepared and, as a consequence, we have seen the system based upon old university methods of scholasticism and tradition gradually fade away, until the bare bones are left, and even they are crumbling into the dust of antiquity out of which they sprung. The science system of education, the "new education," as it is sometimes called, is unassailable, in that it is a natural one, utterly untrammeled by reverence for the past, or devotion to a "school." It seeks nature before the study, and inculcates the acceptance of all truth based upon the facts of nature, as the only sure foundation of a progressive culture. It wars not with ideas, but with error, and is only intolerant of a refusal to accept truth regardless of consequences. It is impatient of shams of all kinds, and quickly pierces the shield of the charlatan. Jealousy, or a desire to restrict knowledge to a few, it is incapable of fostering, but on the contrary is aggressively active in disseminating information among the masses, which in turn produces a reflex action in the elevation of character and morals. The new system is but the legitimate evolution arising from social betterment, and none other than a "material age" could have supported its development. I am aware that this term "material" is often offensive to any well meaning people, but is nevertheless true that the whole history of society shows that all intellectual advancement is based

upon certain material conditions. Food for the stomach, clothes for the back and a cover for the head, are the individual's first needs. Due attainment of these in a greater or less degree is necessary before the receptivity of the mind is such as to appreciate the idea that a man is two sided, intellectual as well as animal. The intellect, like the body, grows by what it feeds upon, and if this food of which it partakes, consists of an active participation in the affairs of commerce, of mines, or manufacture, it is not to be wondered that its legitimate craving becomes a search after the facts and phenomena of nature, the proper appreciation of which is so essential to still higher social advancement. As civilization progresses, the luxuries of one age, imperceptibly become the necessities of the next, and any given generation would deem it a hardship to be compelled to return to the practices of their forefathers. The railway, steamship and telegraph have made the whole world kin, and year by year draw the nations of the earth together, through a community of interest and an enlargement of sympathy.

Before the age of steam, the experiences and observations of men, were limited to the narrow surroundings of their localities. Now the experiences of the world are brought to their feet, and they realize that so far from being independent factors in the guiding of events, they are so many units in the ocean of humanity, with a definite part to play in the scheme of development, and of an importance just in proportion to their power and wealth, both intellectual and material. Glorify the present as we will, we must not despise the past. There are names in antiquity associated with such commanding genius, and almost divine prescience, that they will live so long as literature is studied or science cherished. Emerson says, the "world has always been equal to itself," and take it at any part of its unquestioned history, it only has produced that which its intellectual soil and material condition was capable of nourishing. In the highest sense, the greatest triumph of science has been the reflex action upon culture and morals, as evinced in the emancipation of the minds of men from baneful superstitions, witchcraft, terrors of the untaught imagination, and a harmful reverence for tradition. Omens and auguries, long potent in influencing the actions of men, no longer hold sway except among the ignorant and unlettered. Such mental fetters could not last under a system that teaches men that truth alone is worthy of study, to observe nature and follow her teachings. It is this contact with pure truth that elevates mankind, clears the head and purifies the heart. That broadens the sympathies until they take shape in efforts for the amelioration of mankind, and inculcates the idea that the welfare of society is that of the individual. This spirit of science, which is truth, through self interest and sympathy, finds scope for expression in the building of hospitals, in the organizing of charities, in the improvement of laws, in the extension of the benefits of life insurance; in the elevation of the laborer, and in efforts towards adjusting his relations to his employer. The spirit of science is a great leveler of caste, teaches the equality of men before the law, and shows nations the conditions under

which they can govern themselves without the intervention of kings. It has extended to woman control over her own property, and abolished slavery. The scientific spirit has taught people that disease is not a Providence, but neglect of the laws of health, only to be contended against by a due observance thereof; that epidemics are preventible, and that rain will not fall without the necessary atmospheric conditions for its precipitation. Take all these reflex results of the new system of education, couple them with the direct physical pursuits of science, the improvement in the modes of living, of water supply, of drainage, the railway, the steamship and telegraph; and compare the result in the effect upon the one problem of life, "Human Happiness," with the best that can be said of the old regime of scholastic education. It is the comparison between the electric light and a candle.

What future developments science has in store for us, it would be rash to forecast with any attempt at details. We know that a vast amount remains to be done, so long as an ideal condition of society beckons us on. There is still an incalculable amount of want, and misery, and suffering, in the world; whole communities in ignorance, and many unadjusted questions between labor and capital. What is known as social science is just beginning to take form, and a host of problems growing out of it are to be worked out. The great work of the new educational system in the future will be the training of men to grapple scientifically with these social problems in all their complex relations, political and physical, and to sow broadcast among the people the idea of *causation*. That things proceed not by chance, but by law, that out of nothing, nothing comes, that there can be no effect without a cause, and that the operations of nature are conducted according to a system instituted when matter was formed and force originated. In physical matters, it is hardly probable that the world will ever see again such startling discoveries as those which have fallen to the lot of this century. The spirit of the "new education" will extend its benefits, and in the end carry them to people yet to be civilized. It will send out more workers in physical fields than ever before, but their work will consist in the development of details, and in the careful scrutiny of the by-paths that the past revolutionary discoveries, so to speak, have opened up. Of such work there will be an endless amount, indications of which are seen in the number of investigators in special lines of research, which from past experience we may expect will be sub-divided from time to time into still other special fields of study, as material accumulates. Civilized nations have insensibly adopted a system of divided labor, as a matter of economy partly, but principally because it has been forced upon them by the limitation of human powers. The system is not without its disadvantages, however, in that the specialist, devoted to one class of ideas, is apt to lose sight of the relativity, of all knowledge, and to elevate into a fictitious importance the study he may have in hand. Like the aged German professor who had but one regret on his death-bed, and that was that he had

not been spared a few years longer to complete his investigations of the Greek particle *a*, to the study of which he had devoted his life. The most far-reaching consequence of the general acceptance of the scientific method of investigation, and the latter day broadening of its scope, is its effect upon such speculative and practical questions regarding life, as have profoundly interested men from earliest times. It is pretty plain to most thinking men, that the idea of intellectual freedom is spreading among cultured nations, and with it a broad humanitarian view of men's relations to each other. Under the light of science, old landmarks are being swept away with a remorseless hand, and doctrines and ideas that once seemed as unchangeable as the everlasting hills are being questioned with a penetrating earnestness. What were supposed to be historical facts are either discovered to be no facts at all, or must be so modified in their interpretation, as to have an entirely new significance. Opinions are formed more slowly now than of old, just in proportion as the amount of evidence to be weighed is so much greater now than them. History must be re-reviewed in the light of modern discoveries, which have followed each other during the last quarter of a century, so thick and fast as to task the intellectual strength of a generation to arrange and classify in their scientific bearings. There are more gifted men than ever before, more specialists in every realm of human thought, and more searchers after truth, who, in all parts of the world, are accumulating facts and data, on which the generalizations of future philosophers are to be based. So far as new discoveries and methods bear upon material matters, our only interest is one of present use. We take a new idea to-day, only to throw it off to-morrow for one better adapted to our needs, and so advance from day to day to greater prosperity and comfort. But when we come to estimate the effect of new ideas and discoveries upon speculative matters, and apply the modern scientific method of analysis by induction, we shrink from the inconoclasm thereby involved and often deliberately shut our eyes with stubborn persistence, rather than contemplate for an instant the possibility of error in the cherished teachings of our youth, or in the convictions of mature age. This is perfectly human, is therefore natural, and should not involve the calling of hard names. Being natural, this tenacity in matters of opinion, or of convictions having all the force of truth, play an important part in the scheme of intellectual development, must be weighed as a factor thereof, and not treated simply as an obstinate superstitious phase of human nature to be banished by cynical sneers. Whatever may be the outcome of what may be termed an age of intellectual unrest, through which we are traveling, one thing we can take calm contentment in, and that is in the final exaltation of *truth*, which is the highest aim of science. That end may be a long way off, but so surely as all nature is subject to the law of development and change in some form, so surely will some future generation attain the beatitude of perfect intellectual rest. If, indeed, we ourselves do not find it beyond the experiences of this life—the mysteries of which neither the chemist's crucible nor the biologist's microscope can solve.

XUM

Gentlemen of the graduating class, as a practicing member of your chosen profession, I may be permitted to extend to you the welcome of fellowship. You have entered the profession of civil engineer at a time of peculiar depression in all matters pertaining to public works, railways and manufactures—and have added to the members of a profession full almost to overflowing. It must be admitted that purely professional practice has not a very encouraging outlook to those whose affiliations are not such as to have positions provided for them. In times of great public disaster, such as have followed the commercial world for the last four years, the engineer is the one to first feel the blow, and the last to recover in returning prosperity. His office is one of disbursement, which appears so directly on the expense side of the ledger, that it usually overshadows the indirect benefits with which it should be credited on the other side of the account. He would be a rash man to prophesy a new era of such prosperity as we thought we had previous to '73. How far this prosperity will prove to have been real, it is difficult to say, until all the loose ends are picked up, and the balance sheet finally struck. Just at present the civilized nations of the world are in possession of enormous productive capacities in all departments of manufactures, apparently far in excess of their respective markets. Transportation facilities seem to have fully kept pace with the manufacturing developments, and their extension at this time does not hold out a very enticing prospect to capital—at least in undertakings of any magnitude. It is hopeless to expect a speedy rectification of the lost equilibrium between supply and demand, or that it will be restored without further financial suffering. New markets must be sought in undeveloped countries, and population must increase to a greater or less extent to utilize what the United States, England, France and Germany are now capable of producing. Until the balance is restored, prices will rule low, competition will be fierce, bankruptcies will be frequent, and capital will accumulate at financial centers in safe depositories, at low rates of interest. I must confess that the picture presented is not an encouraging one for the rising generation, but an early acceptance of the situation is certainly philosophical, if not agreeable. My object in alluding to such matters on this occasion, is to disabuse your minds of any ideas you may have formed of an early resumption of constructive activity in new works, which would give ample scope to your professional ambition; and further, to indicate the direction that I conceive to be the one where such an educational training as is given by the Rensselaer Institute will prove of value. I allude to the region of *economics*, the obtaining the most out of the least. In times of high prices, when prices are abnormally large, the idea of profit by saving is apt to be overlooked. On the other hand, when prices are low, the question of any profit at all, is a matter almost entirely of saving, The manufacturer, the merchant and transporter, are all asking themselves, *not*, how large a price they can charge for the commodities in which they deal, or for services rendered. but what is the lowest possible price for which such

commodities or services can be afforded. Such questions involve a multitude of details, and it is just here where scientifically trained men have a large field before them. The economical organization of labor, the perfection of machines, the prevention or utilization of former waste, the rectification of past constructive blunders—are all questions of legitimate scientific study, which invested interests are rapidly recognizing. The economics of transportation, the management of railways and canals, are subjects that will repay the profoundest study, and in these directions the field for a brilliant professional reputation is most enticing. There are numberless vexed questions and unsolved problems in connection with transportation matters, that only scientific methods of thought, coupled with practical experience and observation, can grapple with. Ex-President Grant is credited with the remark, that certain public men had the misfortune to begin their career as major-generals. There is a world of wisdom in the remark, no matter what its source, or to whom it applies. It is, indeed a misfortune to rise in the world more rapidly than one's knowledge and experience warrant. Let me, as a matter of advice, caution you against the ambition of getting ahead too fast. All the schools in Christendom cannot take the place of experience. They can at best only prepare and furnish the mind, so as to make experience *scientifically* usable. It is, therefore, and in fact necessary, for a professional beginner to start low in the ranks, so that he may be familiar with the manner in which things are done, if he ever expects to take a high position in the command of men, and in the management of things. In other words, he must *know* how things are done, before he can *instruct* others to do them. In conclusion, let me remind you, that you go forth under the standard of an Alma Mater that has made a record in almost every state in the Union—see to it, that in your lives and practice, you honor her, as she this evening honors you.—*Van Nostrand's Engineering Magazine.*

FOREIGN CORRESPONDENCE.

PARIS, SEPTEMBER 1st, 1877.

Meteorology is the least known of the sciences, and any progress recently made therein—and it is much—is to destroy many ideas hitherto received as exact. The subject was so near us, observations were so familiar that we concluded to exclude remote causes. Some laws were found to be contradictory, and deductions more apparent than true. It is only now that we begin to observe that solar spots have connection with the weather, and to suspect the stars as producing variations in the atmosphere. We must elsewhere than on the surface of the earth seek the explanation of these disturbances.

The spots on the sun are so gigantic, so enormous, that the earth might pass through one of them without ever producing a shadow. These spots, continuing several weeks and sometimes months, serve as data for calculating the sun's rotation on itself. During forty years M. d'Anhalt-Dessau has noted, day by day, the sun's spots: he found they varied, the maximum and minimum being, in a sense, periodical. Contemporaneously with these observations, General Sabine observed the variations of the magnetic needle. Ordinarily, the latter varies, more or less, towards the east or west. Now these sudden variations, almost nervous-like in their deviations, have been remarked to be greatest when the spots on the sun are most numerous. M. Wolf, of Zurich, after twenty-five years' observations, corroborated this parallelism. Also, photos of the sun have revealed the unexpected and inexplicable fact that when Venus and Mercury are between the sun and the earth the solar spots diminish in size, but resume their primitive dimensions when these planets recede into the distance. The same results have been noted when Venus and Jupiter or Venus and Mercury are in the same degree of latitude in the zodiac, that is to say, in conjunction.

The magnetic needle, as just stated, undergoes variations, more or less abrupt, following the greater or less presence of the solar spots; similarly, inequalities in the variations of the needle have been detected as the planets are in conjunction. Is it not strange, nay, wonderful, to behold the magnetic needle reflecting the movement of stars so distant as Jupiter and so small as Mercury? Is it not singular to observe that needle oscillate more strongly as Jupiter and Venus are in conjunction, or when Mercury approaches the sun? Thus sun and planet act upon a phenomenon—the variations of the needle—till lately believed to be terrestial. But there is more; it has been observed that the cyclones in the Indian ocean were greater in proportion as the spots on the sun reached their maximum; also, that there is an apparent connection between the solar spots and the degree of temperature, and the humidity of the atmosphere. M. Broun affirms there is a relation, beyond doubt, between the revolutions of the sun and moon and the variations of the needle and the fluctuations of the barometer. All these phenomena seem to indicate that they are not the cause, the one of the other, but the effect of a dominating cause, up to the present unknown.

The extraordinary curative properties of salicylic acid and its combinations has led to its application for the purposes of adulteration. The poisonous fuchsine has been used to color wine; now salicylic acid is employed to preserve it, but not in the charitable end to cure articulate rheumatism. This new agent of adulteration is dangerous, for we are not quite certain about the real properties of the acid. As the latter "preserves" wine, there is no reason why it ought not to be employed to "salt" milk and butter, in fact, used everywhere as a preventive of fermentation and putrifaction. Despite the measures taken in France to protect the public health it is the exception to find articles of food pure. Tea is so adulterated with

powdered iron, which is gummed to the leaves, that if a magnet be thrust into a package on being withdrawn it will be found to be covered with particles of iron—a metal not so bad as copper, certainly, and superior to gypsum, Prussian blue and black lead.

It is often necessary to suddenly augment the power of marine steam engines, for a short period. To do so, the intensity of the furnace must be increased, and this is effected either by means of an energetic ventilator or introducing a jet of steam from the boiler. M. Bertin, naval engineer, prefers the second plan, as the first often occasions loss of life if the door of the furnace be opened incautiously; but he has invented a machine, now employed on board the Resolute, frigate, by which blasts of compressed air are suddenly forced, by means of a centrifugal ventilator, through the bottom of the furnace. The combustion is doubled under the transitory action of the jet, and the motive power increased in the same proportion. There is an increase, also, of 20 per cent. in the consumption of fuel. M. Cailletet, to whom we are indebted for the invention of burning the gases which escape from ordinary fires, has effected the same for the gases of the chimneys of manufacturies, utilizing the heat generated by their combustion. The gases at the forges of Chenecière, which escape from the furnaces, pass under a boiler 30 feet long, which they heat, then they pass into a fire-brick chamber containing a metal box, inside of which are thin plates of metal that the gases maintain at the required temperature.

The "writer's cramp" is so called, doubtless, because it is neither a cramp nor peculiar to penmen. It is an impotence, resulting from a complete absence of harmony between the muscular and the cerebral movements. A person suddenly feels he cannot write, though his hands are capable of all other work not requiring excessive precision; often the pen falls from the fingers or involuntarily lifts itself up in the air, when the writer must await its good pleasure to descend before commencing another word. The disease may be considered as incurable, and the afflicted ought to consider himself happy if able to write with the left hand. The "piano cramp" is due to the same cause, performers being suddenly unable to continue touching the keys. Often the disease in this case manifests itself in the front part of the upper portion of the arm. M. Onimus attests that the affection is not uncommon with violinists, and the clerks of the Morse telegraph not only suffer in the same way in their fingers, but along the whole arm. A tailor, when he commenced to sew, noticed his arm turning inward, and fencing-masters can observe the same phenomenon with their swords, although, in both cases, the arm is capable of perfectly executing every other kind of work. A cobbler suffered so much from these contractions that they affected his neck and face, causing him involuntarily to make the most hideous grimaces. The feet also can be attacked. Duchenne quotes the case of a turner, whose foot contracted the moment he put it on the pedal of the ma-

chine, though that member was excellent for every other function. The "dancer's cramp" is only another form of the same effect. An enthusiastic clergyman, in order to lead the singing in his church, learned to play the ophicleide; he exhibited so great a passion for the instrument that when he performed he executed such serpentine contortions as to provoke laughter in his flock. Duchenne was of the opinion that the disease is produced by an excessive excitement, or the exhaustive exertion of certain muscular functions, producing a too considerable nerve discharge, and hence, contractions. Professor Bouilland is of the opinion that the malady has its starting point from the nervous centre of the brain, which commands, as is well known, many movements, as those of the eye, speech, and writing. The "cramp" is then simply a paralysis; it is sometimes accompanied by the loss of speech and the power to read. The Professor quotes the case of a civil engineer, who lost the power of speech and writing, yet could read mentally. As physiological, man is in duplicate, if the left hemishphere of the brain refuses to act with the movements of written language, the right hemisphere will be found generally intact and capable of commanding the left hand to function.

M. Blanchard explains the apparent anomaly why an insect, after undergoing all its metamorphoses, becomes, on reaching the adult or leaving stage, enormously larger than the chrysalis in which it was contained. It is not the air introduced into the breathing tubes, as De Belleyne believes, but the insect breathes the air by its mouth, filling its digestive tube with this gas, which sends the blood towards the circumference of the body, obtaining thus mechanically the unplaiting of its wings and the normal swelling of its body.

The discovery of an ante-diluvian elephant by some Siberian fishermen, who were able to eat some of its flesh, draws attention to the question "how did these mammoths come there?" The general idea is that at one time the northern regions enjoyed a tropical temperature, which some cataclysm changed. M. Boyle is of a different opinion; the elephants thus found from time to time in Siberia, have neither lived nor died in that region. At the epoch of the great cataclysms they were transported by strong currents of water from the Himalaya as far as Siberia, where they were stopped and imbedded in the ice. This transport would not have been of long duration. The elephants were very numerous at that period; all were not carried northward, as many remained *en route*, as their bones and tusks testify. In China the ivory employed is that of the fossilized tusks of extinct mammoths, excellent for sculpturing purposes, and English and American fishermen who go far north, haul up with their nets many of these tusks, which are known in commerce as "fossilized ivory."

M. Daubree has made, since some years, meteoric stones his special study. What has produced upon the fragments those erosions and fissures which

are the distinctive features of aërolites? M. Daubree asserts, from repeated experiments upon metallic surfaces with gunpowder and dynamite, he has produced the same cavities as in the aërolites, and which are simply due to the expansion of compressed gases. The honey-comb surface of these meteorites is then not due, as is commonly supposed, to the scaling off by the unequal expansion of these extra terrestrial bodies. M. Daubree has produced the same characteristics on iron and zinc. The pressure which our atmosphere exercises on these bodies, on their arrival within its influence, is very great, as they enter at a rapidity of over 60 miles a second; hence, the fragmentation of the aërolite, its successive explosions, its breaking up into a shower of tiny stones, or assuming the appearance of a "swarm." As these bodies have to support a pressure of 3,000 atmospheres, their incandescence is as natural as the fusion of their surfaces.

M. Menier draws attention to pulverization of manures and of soils, as stimulating the action of each. Pulverizing often moderates most completely the properties of bodies in flavor, odor and color. Sugar, too finely powdered, loses too much of its saccharine qualities, takes an odor of caramel and a taste of starch. The more carbon is finely divided, the more it is efficaceous as a deoderizer and disinfectant; hence, why animal black is in such request as a filter in sugar refineries. The finer the body, also the more rapid the dissolution, because a greater surface can be acted upon by water or acid; hence, why powdered feldspar is a manure, by yielding its potash, ground-fossil bones and phosphates. By pulverizing the soil, the farmer discounts the work of time, and by doing the same for manures, he helps the efforts of the roots.—P. C.

CHEMISTRY.

SPECTROSCOPIC DISCOVERY OF OXYGEN IN THE SUN.

Celestial chemistry has taken another stride forward. In a paper recently read before the American Philosophical Society, and printed in the *American Journal of Science and Arts*, Dr. Henry Draper announces the discovery of oxygen gas in the sun, the fact being arrived at and verified by a long course of spectroscopic observations.

Viewed in any of its numerous aspects, this discovery is of immense interest. Whether as an extension of our knowledge of solar physics, solar chemistry, and the nature of the spectrum itself, or as throwing further light upon the constitution of the universe; whether as bearing upon cosmical theories that have attracted much attention, or as a triumph over the difficulties of complicated experiment, or, finally, as an illustration of hereditary genius in science, where a line of research opened brilliantly by the father

nearly half a century ago, has been pursued with equal brilliancy to this crowning result—however regarded, this exploit of the younger Draper must command unqualified admiration.

As has been repeatedly shown in our pages, the early Draper was one of the early and most successful explorers of the chemical relations of the luminous spectrum. He was a pioneer in this line of investigation, and the first to make extensive use of photography in this branch of research; and he was so far in advance of his time, that his discoveries were totally unappreciated. But he furnished the fortunate men who followed him with their tools to reap the splendid harvest of spectroscopic discovery, which has so impressed the world during the last eighteen years. We have never had any doubt that history would set all these things right, but the venerable doctor will at any rate be easy in the assurance that the sceptre has not departed from his family.

When it was established that the light emitted by vaporized and incandescent bodies gives spectra by which they may be identified, the passage was rapid to the discovery of chemical substances by the analysis of light. A study of the spectra of the sun and stars soon gave evidence that they contained forms of matter with which we are familiar upon earth. All the metals, for example, in a state of luminous vapor, yielded bright lines in the spectrum so distinctive in each case that there was no possibility of mistaking them. When these were carefully mapped and compared with the spectra from the sun and stars, such a startling mass of coincidences was at once disclosed, that there was no escape from the conclusion of a common causality, or that these metals exist also in the stellar bodies. There was but one serious difficulty. The lines obtained by the combustion of the the metals were bright and colored, while the corresponding lines in the solar and stellar spectra were all dark. Kirchhoff resolved the difficulty in 1859, by showing how the bright lines may become dark lines by absorption in such conditions as the celestial bodies furnish; and it was thus not only established as a fact that there are various terrestrial metals in the sun and stars, but their mode of manifestation was brought into complete harmony with theoretical requirements.

The nebular hypothesis, which had been growing for a century, and which assumed the origin of all the bodies in the solar system from a common nebulous source, was, of course, at once and profoundly affected by the new revelations. It was proved that there are common elements extensively distributed among celestial bodies, which confirms the hypothesis that they have a common origin. Not only was there new and positive proof of the existence of nebulous matter in the celestial spaces, but the ultimate elements of which material Nature is constituted were shown to be universal, and the nebular hypothesis was thus strongly confirmed. Yet a difficulty at once arose, that the main predominant elements terrestrial Nature were not found to exist in the sun and stars. The evidence, of course, was negative, but it was held by many to be weighty, in disproof of the nebular doctrine.

If the non-metallic elements, it was said, which form the principal part of terrestrial objects, do not exist in the sun, the derivation of that body and of its encircling planets from the same primeval source is impossible. Dr. Draper has now proved that oxygen in large proportions exists in the sun (and probably nitrogen also); and his discovery can therefore only be regarded as lending further and more powerful confirmation to the nebular hypothesis.

Dr. Draper's paper, in the *American Journal of Science and Arts*, is accompanied by an illustrative diagram, which brings the demonstration before the eye of every reader. It exhibits the spectrum of the sun, and that which is produced from air, so juxtaposed that the fact and the extent of the identity of the lines in the two representations are seen at a glance. The matching and identification are even more complete than they were in the original experiments of Kirchhoff with the metals, for here it is not necessary to invoke a theory for the unification of bright and dark lines; the bright lines of the spectrum of oxygen being continuous with the bright lines of the solar spectrum. It is, indeed, because the solar oxygen reveals itself by bright lines that these have not been earlier detected, as they have been masked and concealed among the unoccupied luminous spaces, between the dark lines that have hitherto been the main objects of attention.

Dr. Draper has been occupied for several years with this investigation—in fact, he has grown into it. Besides his inherited aptitude, and life-long training in this delicate line of manipulation, and his thorough familiarity with the peculiar difficulties of these investigations, his work could only have become successful by means of a combination of appliances, some of which are only lately available. His task was to produce a gas spectrum, and maintain it at a brilliancy which would admit of its being photographed alongside of that of the sun itself. Oxygen is made incandescent by electricity. The most ample, steady, and sustained command of this agent was therefore indispensable. This was secured by the Gramme machine, a dynamo-electric engine connectedwith a large induction-coil and a battery of Leyden-jars. The impulse was furnished by a Brayton petroleum-motor, which "can be started with a match, comes to its regular speed in less than a minute, and preserves its rate entirely unchanged for hours together." This was belted to the Gramme machine, which, at its usual rate of running, gave 1,000 ten-inch sparks per minute. This "torrent of intense electric fire," consisting of twenty ten-inch sparks per second, was passed through Plücker's tubes, containing oxygen, the spectrum of which is thrown upon a sensitive photographic surface, while the solar spectrum is formed beside it, and both are fixed together upon the tablet. The embarrassments of the investigation are thus referred to in Dr. Draper's paper:

"This research has proved to be more tedious and difficult than would be supposed, because so many conditions must conspire to produce a good photograph. There must be a uniform, prime-moving engine of two-horse power, a dynamo-electric machine thoroughly adjusted, a large Ruhmkoff

coil with its Foucault break in the best order, a battery of Leyden-jars carefully proportioned to the Plücker's tube in use, a heliostat, which of course involves clear sunshine, an optical train of slits, prisms, lenses, and camera well focused, and, in addition to all this, a photographic laboratory in such complete condition that wet, sensitive plates can be prepared which will bear an exposure of fifteen minutes and a prolonged development. It has been difficult to keep the Plücker's tubes in order; often before the first exposure of a tube was over, the tube was ruined by the strong Leyden sparks. Moreover, to procure tubes of known contents is troublesome. For example, my hydrogen-tubes gave a spectrum photograph of fifteen lines, of which only three belonged to hydrogen. In order to be sure that none of these were new hydrogen-lines, it was necessary to try tubes of various makers, to prepare pure hydrogen and employ that, to examine the spectrum of water, and finally to resort to comparison with the sun."

In regard to the significance of the inquiry in relation to spectroscopic study, Dr. Draper remarks:

"We must, therefore, change our theory of the solar spectrum, and no longer regard it merely as a continuous spectrum with certain rays absorbed by a layer of ignited metallic vapors, but as having also bright lines and bands superposed on the background of continuous spectrum. Such a conception not only opens the way to the discovery of others of the non-metals, sulphur, phosphorus, selenium, chlorine, bromine, iodine, fluorine, carbon, etc., but also may account for some of the so-called dark lines, by regarding them as intervals between bright lines."—*Popular Science Monthly.*

LEATHER NOT A CHEMICAL COMPOUND.

Chemistry, though it is not exceptional in that respect, is a science in which we are continually unlearning as well as learning. It was formerly believed, and the text-books still assert, that leather is a true chemical combination formed by the hide and the astringent matter. The researches of Knapp have thrown new light upon this question, proving that leather can not possibly be a chemical compound. He has succeeded in making leather without any tanning matter by merely driving the water out of the pores of the hide by means of chloride of calcium and anhydrous ether, and he has then reconverted this leather into its original state of hide by leaving it to steep in water. The experiments of Knapp show that in tanning, the special agent are not absorbed by the hide in an invariable quantity, but that the proportions depend on the degree of concentration and on the nature of the solvent. To penetrate into the hide, to enfold the fibres, to cover them with a precipitate by surface attraction—this is the only part played by the tanning principles. Owing to their presence, the fibres during the drying of the hide do not form a horny mass, but remain supple and flexible. Leather is a really mechanical mixture, and tanning is only a special case of dyeing—*Boston Journal of Chemistry.*

FLORICULTURE.

ROSES IN-DOORS AND OUT.

Among the various plants that can be made to bloom in the window during the winter, but few give more satisfaction, when it does well, than the rose. The New York *Tribune* tells how to manage them so as to make them succeed:

Roses may be grown in-doors with very little trouble, and those who fail have lack of knowledge—a minus quantity generally known as "bad luck." Take the precaution to first remove all the foliage, and cut well back every portion of the unripe wood. The root must never be allowed to dry in the least.

Prepare a little loamy soil from under the sod of an old pasture, or along roadsides, and incorporate with it a portion of clean bar sand. A small quantity of old rotted manure will also be beneficial, though we rely more on liquid fertilizers applied while the plant is in a growing state, as that is the time only when such stimulant is needed.

In potting the plant fill in an inch or two of drainage (some writers maintain that this is useless, but we believe it to be essential to perfect health), and then a portion of the prepared soil. Place the roots in a natural position, do not cramp them, and then fill in gradually the remaining soil, giving the pot an occasional shake to settle the earth well in among the fibres and at the same time press the surface firmly. As a general rule, plants thrive much better when the earth is hard than when left loose and light. The strawberry, for example, cannot be forced to advantage unless the soil has been pounded firm before the runners take root. After potting thoroughly soak the soil, and place the plant in a cool, shady situation until hard frosts set in, when it may be removed to a warm room.

One of the chief points to be observed in forcing all plants is to perform every stage of the process quietly, always beginning in time so as never to hurry vegetation, which is invariably done at the expense of vitality. Plants must have due time to form fresh rootlets in the soil before the leaves and young growth commence their work. Some people put a plant right out of the garden on the approach of cold weather, and then immediately remove it to a warm, sunny window, often forgetting to water it for a long time, and of course it presently becomes "sicklied o'er," and droops. As to varieties of roses for potting, one can not go far astray with the Teas and Chinas; but avoid particularly the Mosses and Hybrid Perpetuals, as these will bloom but once during the winter, and then only sparingly, and with the greatest reluctance. Such good old standbys as the White, and Pink Daily, Hermosa, Agrippina, Safrano, and Cels, as well as the newer Bon Silene and Isabella Sprunt, are always reliable. Do not try to do too much

at first—the great blunder of beginners. One or two plants will be enough to start with; another winter one can "launch out." But it is well always to remember that a few specimens, even one in fact, in perfect health, and full of bloom, is far more valuable than many in an unthrifty condition.

A few words in relation to roses which are to remain in the open ground over winter. It is an excellent plan to head back the more tender varieties severely—say within nine or ten inches of the ground—and then cover with coarse manure and litter from the stables. But don't kill with kindness; don't give a coat of manure that would cover the garden, and expect the plant to survive. This is almost certain death. The object is not to keep the plant warm, but to preserve it cool and free from the fluctuating temperature of our trying winter. Sudden freezing and thawing is what does the mischief.

The hardier kinds need only a little protection from the sun, such as is afforded by a few bows of evergreens or rough weeds; but it is a mistake to tie them tight. A particular friend once put his up nicely in corn fodder, thus affording an excellent lodgment for mice—a courtesy which these rodents, with sharp ingratitude, reciprocated by eating up bushes, protection and all. In every case head well back, trimming out the old wood, and the nearer the ground the better; then give each plant a good fork-full of manure, which answers a double purpose.

TO PROPAGATE ROSE SLIPS.

1. There are several methods of propagating rose-cuttings, but one of the simplest is to strike them in a saucer of sand. The wood to be used must be of the present season's growth; the small shoots are preferable. These should be cut into lengths of about four inches (the exact size is immaterial), having three or four eyes or dormant buds. There should be an eye at the bottom of the cutting, as it is at that point the roots are emitted, and not between the eyes. Procure some clean brown sand, such as is used by builders, put it in a saucer, wet it thoroughly, so that it shall be in the condition of mud, then place the cuttings in side by side, having previously cut off their leaves. Place the saucer in the sun and mind that it must have water several times daily, when the sun is hot. The cutting will form what is called a "callous" at the bottom, from which the roots are emitted. Three or four weeks are generally necessary to get the cuttings well rooted, after which they may be carefully pulled from the soft sand (and be sure that it is soft, as the roots are very brittle), putting them in small pots of light, rich soil, and keeping them in a sunny place. Never let them suffer for want of moisture. If the pots can be sunk in the ground, so much the better. When the pot is filled with roots the young plant should be shifted to a pot a size larger. All varieties of roses do not root with equal readiness—the tea or everblooming roses being the easiest, and the mosses the

most difficult. Rose cuttings may be struck at any time of the year and in a warm place, if the wood is young. They may be struck in a tumbler of sand, washing the sand carefully out in a basin when the roots appear. The "saucer system" of striking rose cuttings is applicable to cuttings of many plants which I have failed with by the ordinary methods. I would advise those who attempt it not to be impatient, and, above all, not to forget that the hot sun soon causes the water in the saucer to evaporate.—*The Fruit Recorder.*

HOME DECORATION.

We are pleased with the idea of the *Forest and Stream* that people should provide grasses for bouquets, and, as it says, "Just at present in meadows and hedgerows the different varieties of wild grasses can be obtained in perfection, and they should be much more extensively employed in floral decorations than they are, for not even the most delicate greenhouse fern will give the same airy look to a vase of flowers that a few spikes of wild grasses will impart. It is only a few years since they were first brought into requisition, and ever since—especially in England—their use has been steadily increasing. It is a good plan to lay in a store of the different varieties of grasses at the present time for use during the winter months, when they cannot be obtained in the fields. In cutting them for this purpose each variety should be tied in separate bunches, and care should be taken that they are not bruised together; for if this is the case when the bunch is opened each spike will be found to have dried in its crushed position, and its form will thus be quite spoiled and its value for decorative purposes destroyed. All grasses should be dried in an upright position, particularly those of a drooping character. Oats and rye while still green are also very pretty in large arrangements, ears of black oats which are seldom seen used and which form a striking contrast to grasses and sedges.

To Preserve the Natural Colors of Dried Plants.—The following method of doing this is given in a German pharmaceutical journal, and will interest botanists and others: Dissolve one part of salicylic acid in 600 parts of alcohol, heat the solution to boiling in an evaporating-dish, and draw the whole plant slowly through it, prolonged exposure discolors violet flowers; shake off any excess of liquid, dry between blotting paper, and press in the usual manner. A frequent renewal of dry blotting pads, particularly at first, is desirable. Thus treated, plants are said to dry rapidly, furnishing beautiful specimens, which retain their natural colors in greater perfection than by any other process.—*The Fruit Recorder.*

THERAPEUTICS.

PATENT MEDICINES AND SECRET REMEDIES.

The German chemists are very unmerciful to those who would impose upon the public by worthless preparations; and one Berlin journal the *Industrie Blätter*, edited by Dr. E. Jacobsen, offers to analyze *gratis* any patent medicine sent to them in the original package. The analyses of over *eleven hundred* such preparations, made by Dr. Hager, Wittstein, Rose, Chandler, Reveil, and others, have been collected together by E. Hahn and published in book-form by J. Springer. A few of these analyses we propose to lay before our readers for their information and amusement, remarking, however, that in some cases it is impossible for the analyst to exactly determine some of the organic remedies, such as gums, balsam, and resins, when in combination or solution, and noting the difficulty of accurate translation of pharmaceutical terms:

Dr. Pierce's Golden Medical Discovery. A one dollar bottle holds 220 grains of a brownish colored clear liquid, consisting of 15 grains pure honey, 1 grain extract of poisonous or acrid lettuce (bot. *herba lactucæ virosæ*), 2 grains laudanum, 100 grains dilute alcohol (64 per cent), tasting like fusel oil and wood spirit, with 105 grains of water.

Dr. Livingston's Ant Balsam, a German remedy, consisting of 72 grains castor oil, 2 grains balsam Peru, and 5 drops oil of bergamot.

American Tooth-ache Drops, made by Majewsky in Warsaw, have different compositions. Those which took the prize at Vienna consisted of common salt and brandy, colored with harmless cochineal red (price, 37½ cts.).

Asthma Pastils (Danl. White & Co., New York), according to the analysis of Dr. Fleck, contain 20·1 per cent saltpetre, 3·5 per cent impure scammonium resin, 35·0 per cent gum and sugar, 40 per cent charcoal powder, leaves and stems of some plant.

Ayer's Pills consist of peper, colocynth, gamboge (*gutti*), and aloes.

Ayer's Hair Vigor, a solution of 0·6 per cent of sugar of lead.

Horsford's Baking Powder. One powder contains acid phosphate of lime and magnesia mixed with a certain quantity of flour; the other is bicarbonate of soda.

Berlin Balsam, for cure of all kinds of sores, burns, cuts, wounds, ulcers, chilblains, etc., is nothing but common glycerine contaminated with a considerable amount of chloride of calcium.

Cook's Balsam of Life is a filtered decoction of 20 parts borax in 250 parts water, and 1½ parts pulverized camphor in 1 liter of liquid. Used externally for toothache and all skin diseases.

Bucher's Fire Extinguishing Powder contains 59 parts saltpeter, 36 of sulphur, 4 os charcoal, 1 of oxide of iron. We fail to see the advantage of this peculiar sort of impure gunpowder as a fire extinguisher.

Non-poisonous (?) Fly Paper, from Bergmann & Co., in Rochlitz, contains a large amount of arsenic!

Iodine Cigars, from J. D. Tormin, in Stettin, bear the motto "No more phthisic;" but contain no trace of iodine. Can the Yankees beat this?

Hamburger Tea contains 32 parts of senna leaves, 16 of manna, 8 of coriander, and 1 of tartaric acid, ground up together.

Dr. Sage's Catarrh Remedy, says Schädler, contains 0·5 grammes of carbolic acid, 0·5 grammes camphor, and 10 grammes common salt, which are to be dissolved in 4-7 liter of water, and injected into the nostrils. It appears very probable that the wide reputation of this remedy is a deserved one, and the publication of its constituents will rather increase than retard its sale.

Croup Powder, from F. W. Gruse, in Berlin, contains 25 parts of common salt, 10 of flowers of sulphur, 25 of fœnum græcum, 25 of juniper berries, 5 of gentian root, and 5 of fennel seed.

Horn's Liton, infallible cure for tooth-ache, contains 5 parts of phosphate of lithia dissolved in 400 parts of alcohol.

Schenck's Mandrake Pills. Hager says that these pills contain no mandrake. They do contain the constituents of cayenne pepper, a bitter extract, and some vegetable powder containing tannin.

Bishop's Granular Effervescent Citrate of Magnesia. According to Löhlein, it contains neither citric acid nor magnesia, but is merely a mixture of bicarbonate of soda and tartaric acid.

Poho, a Chinese essence for headache, etc., consists, according to Hager, of good and pure peppermint oil, rather hard and resinous. According to others, it is a mixture of Epsom salts and peppermint oil, or of the latter with oil of almonds.

R. R. R. consists of a reddish-yellow liquid, that smells of ammonia and camphor. It contains 14 parts soap, 40 parts of 10 per cent ammonia, 640 parts alcoholic extract of cayenne or Spanish pepper, 4 parts camphor, and 2 parts rosmarin oil.—*Scientific American.*

Freckles, and How to Treat Them.—Many remedial preparations of a complicated character have been recommended, of which *New Remedies* gives the following:

R	Zinci sulphocarbol	2 parts
	Glycerine	25 "
	Aq. rosæ	25 "
	Spiritus vini rect	5 "

Dissolve and mix. The freckled skin is to be anointed with this twice daily, the ointment being allowed to stay on from one-half to one hour, and then washed off with cold water. Anæmic persons should also take a mild ferruginous tonic. In the sunlight a dark veil should be worn.

XUM

A French journal recommends a collodion containing ten per cent. of its weight of sulphocarbolate of zinc, as giving excellent result. The solutions of corrosive sublimate and other mercurial salts, often used for the purpose, are more or less dangerous, and should be avoided. The following lotion, which contains only a minute proportion of mercury, is harmless and well recommended:

℞ Hydarg. perchlor.....gr. v.
Acid. hydrochlor.....gtt. xxx.
Sacch. alb.....℥ i.
Spt. vin. rect.....℥ ij.
Aquæ rosæ.....℥ vii.

The following formula is also highly recommended:

℞ Sulphocarbolate of zinc..... 1 part.
Collodion.....45 parts.
Oil of lemon..... 1 part.
Absolute alcohol..... 5 parts.

The sulphocarbolate of zinc should be reduced to an extremely fine powder, and should then be thoroughly incorporated with the fluid mixture.

Here is an other, in which white mustard-seed and lemon juice are the chief ingredients.

℞ Pulv. sinapis alb.....℥ iij.
Olei amygdal.....℥ ss.
Succi limonum, enough to make a thick paste.

Mix. To be applied as an ointment.

It is also said that powdered nitre, moistened with water, and applied night and morning, will soon remove all traces of freckles. An old fashioned household prescription is sour milk or butter milk, which may sometimes answer the purpose.—*Boston Journal of Chemistry.*

Ammoniated Tincture of Guaiacum for Inflamed Throats.—Dr. Garner, in the *Canada Lancet*, recommends the use of ammoniated tincture of guaiacum in inflammation of the throat whether acute or chronic. The remedy, he says, seems to be totally unknown to some practitioners, and wholly ignored by others. He prescribes it with almost invariable success in cases of chronic hoarseness, employing it in the form of a gargle. In the first stage of quinsy its action is astonishing. In cases of inflamed tonsils or sore throat, when produced by or accompanying measles, scarlatina, cynanche, parotiditis, and croup, he uses the pure tincture by means of a sponge-probang. His formula for a gargle is as follows:

℞ Tinct. guaiaci ammon.....℥ iij.
Liquor. potassæ.....℥ iij.
Tinct. opii.....℥ ij.
Aq. cinnamomi.....ad f. ℥ viij.

RICORD'S COUGH PILLS.

Morphiæ hydrochloratis..... gr. v.
Extracti hyoscyami..... " viii.
Rad. belladonnæ pulv.,
Rad. glycyrrhizæ pulv.,
Mellis.....āā " xlv.
Balsami tolutani,
Ol. theobromæ .....āā " lxxv.

Make into 100 pills. Each contains 1-20 grain of hydrochlorate (muriate) of morphia.

Dose: One pill every 5 or 6 hours in chronic bronchitis, accompanied with cough.

SCIENTIFIC MISCELLANY.

ETRUSCAN REMAINS IN PERUGIA.

The Etruscan remains of Perugia are few, owing partly to the great fire, which, in the year 41, destroyed almost the entire city. Enough of the ancient wall, however, still exist to show the manner in which the Etruscans built, the immense blocks of stone being put together without cement. A few miles outside of the city, in 1840, some laborers plowing in a field were astonished to see the oxen sink down in the earth. Investigation proved that they had broken through the roof of an Etruscan tomb, which was speedily uncovered, and found to consist of ten chambers, and to be full of stone coffins, ornaments, lambs, drinking vessel, and all the paraphernalia of pagan obsequies, in perfect preservation. Most of the coffins have been removed and opened, and many curious objects found in them, which are exhibited at the University Museum, and a visit to the tombs themselves is one of the most interesting excursions about the city. Among the principal treasures of that museum are the Etruscan inscriptions which have been discovered in great numbers in the neighborhood of the city. One of them is the largest on record, consisting of forty-five lines. But its meaning, and even its subject, still remains undetermined, even after the investigations of the best authorities on Etruscan subjects. One is offered quantities of "Etruscan relics" such as bronze idols and stone spear heads, all over the city, but it is well to doubt their genuineness. Of the Roman rule in Perugia there are abundant memorials. In fact one feels that a thousand years is but a little space in history, as one recalls the past of this ancient city—(yet not so ancient as some of its neighbors)—which was

growing old before Rome was born! One almost wonders, after straying through the city, to come out into old portions of the corso, the principal street of the modern city, and find the evidences of contemporary civilization. A sewing machine in Perugia seems an anomaly, and gas-lamps a satire.—*Springfield Republican.*

SIBERIAN NATURAL HISTORY.

Dr. O. Finsch, lately returned from a scientific expedition in Siberia, has opened at Bremen an exhibition of the ethnographic and natural history collections made by him during his travels. The specimens have been duly classified by Dr. Finsch himself, and, according to *Die Natur*, whose account of these valuable collections we follow, give a good general idea of the kind of life led by the inhabitants of Western Siberia; in this respect they surpass even the Imperial Museums of St. Petersburg and Moscow. The inhabitants of the whole region of the Obi, lying north of the confluence of the Irtish with that stream, live exclusively by fishing, hunting, and reindeer-breeding. The reindeer is the principal source of their wealth, but the herds have been ravaged during the last forty or fifty years by spenitis, and thus the people have been reduced to great straits. For instance, we are informed that Ivan Taisin, Prince of Oddorsk, who twenty years ago owned 7,000 reindeer, now has only 700. Dr. Finsch's ethnographical collection consists of the following groups: 1. Women's and children's clothing, articles of feminine adornment, needles, and thread, etc; 2. Household furniture and culinary utensils; 3. Men's clothing; 4. Instruments used in hunting and trapping; 5. Sundry other implements, together with requisites for smoking; 6. Fishing outfit; 7. Articles used in public sports and in gaming; 8 Reindeer-harness; and 9. Objects used in religious worship. Besides there is a complete state dress of a Tungu notable, as also sundry specimens of Turkistan and Siberian manufactures. The natural history collection includes a portable herbarium, a great herbarium of plants from the Altai region, mosses, arctic berries, butterflies, beetles, bees, flies, locusts, spiders, shells, reptiles, fishes, and birds, and the last in great variety. Then there is a collection of human skulls, and a number of paleontological specimens. Finally, the economic products of Siberia are represented by specimens of skins, farm-produce, manufactures, ores, and metals.—*Popular Science Monthly, Supplement.*

ARE WE APPROACHING A SECOND ICE PERIOD?

Translated for the Globe-Democrat from a Swedish paper.

Speaking of the summers continually growing colder, the paper referred to makes the following observations, well worthy of attention. It says:

Fossils and very peculiar remnants of palm trees have been discovered

in Greenland Bay near Koma, whence we deduce that those regions were formerly covered by a rich vegetation. The ice period of the geologists appeared, and in consequence of the sinking temperature that luxuriant vegetation was wrapped in a shroud of snow and ice.

The temperature sinking, a phenomenon which extended from the North southwardly, and may be established by evidence derived from geology, to wit, by the discovery of fossil plants, seems also to be on the increase in our days. Within the last few years the ice seems to have pressed on from the North Pole far southwardly, as for instance, colossal bodies of ice have been accumulated between Greenland and the Arctic Ocean. On the European coast mariners have come upon ice in latitudes where, in the milder season they usually do not find any, and the cold weather on the Scandinavian Peninsula this summer is derived from the bodies of ice floating about in regions where the gulf stream bends in the direstion of our coasts.

It is a repetition of the observation made in the cold summer of 1865. That unusual vicinity of those bodies of ice made the climate of Iceland so cold that the grain will no more ripen, so that, in view of threatening famine and cold, the Icelanders will have to establish a new home in Norht America. It was the same in the fouoteenth century in Greenland, when the Norwegian colonies were destroyed by the bodies of ice pressing onward.

BERLIN PNEUMATIC DESPATCH.

The proposed pneumatic despatch line in Berlin will have 26 kilometres of tube, and 15 initial stations. The wrought-iron tubes have a clear breadth of 65 millimetres, and lie about one metre below the surface of the ground. The letters and cards which are to be forwarded have a prescribed size, and are inclosed in iron boxes or cartridges, each of which can hold 20 letters or cards. In order that they may pack closely, they are covered with leather. From 10 to 15 cartridges are packed and forwarded at a time; behind the last cartridge is placed a box with a leather ruffle, in order to secure the best possible closure of the tube. At four of the stations are the machines and apparatus needed for the business. The forwarding of the boxes is effected either through compressed or rarefied air, or through a combination of the two. Steam-engines of about 12 horse-power are used for the condensation or exhaustion of the air. Each main station has two engines, which drive a compressing and an exhausting apparatus, the steam for each engine being furnished by two boilers. Large reservoirs are employed both for the condensed and the refined air. The former has a tension of about three atmospheres: the latter, of about 35 millimetres of mercury. The air, which is heated to 45° C. by the compression, is cooled again in the double-walled cylinders which are surrounded by water. The velocity of the boxes averages 1000 metres per minute, and a train is despatched every 15 minutes. Each of the two circuits is traversed in 20

minutes, including stoppages. The entire cost of the enterprise will be about 1,250,000 marks (300,000 dollars).

ENGLISH RAILWAYS.

Much has been written in praise of the thorough construction of English railways and the excellent condition in which they are kept. No doubt, as a rule, they are better built than American roads, and they are generally well cared for; but we have lately seen abstracts of a report made to the Bristol Board of Trade on the condition of an important section of the Great Western Railway, which shows that one of the leading lines in England, and the one on which the fastest trains in the world (53 to 54 miles an hour) are run, is, or *was*, in a disgraceful and dangerous state. A serious accident which had occurred on the line was attributed to the imperfections of the permanent way. A competent agent was sent by the Board of Trade to make an independent inquiry, and he inspected minutely, not only that part of the way situated at the place of the accident, but the whole line from Bristol to Exeter, 77 miles in length, carefully examining every rail and every sleeper, and their adjuncts. While this inspection was proceeding, the company set energetically to work on repairs, employing at one time upward of 500 men in addition to their ordinary staff, and using up £50,000 ($250,000) worth of materials. The conclusion reached by the inspector was, that when he commenced his examination there existed on the Bristol and Exeter section of the Great Western 11,260 defective rails and 8,117 defective timbers, not to mention bolts, plates, and other accessories, imperfectly connected and otherwise incapable of safely resisting the excessive strain of a heavy train rushing along at a speed of nearly a mile a minute, and probably sometimes exceeding even that. Is it likely that so bad a state of thing could be found on any American railway of equal importance—say, on any of the great trunk lines from Boston or New York. *Journal of Chemistry.*

ASBESTOS

It is only quite recently that this substance has risen from being simply a mineral curiosity to a quasi-important article of commerce. On account of its peculiar qualities, being indestructible in fire or by acids, fibrous and capable of being woven into cloth or made into paper, often as fine as the finest flax or silk, or like spun glass, although strictly a mineral product. In early antiquity it was made the subject of curious myths and strange tales bordering on the fabulous. Practically its sole use then seems to have been for winding sheets, in which to burn distinguished dead, or to be spun in napkins which were used at exceptional feasts, and, to the astonishment of the guests, afterwards thrown into the flames, to come out intact, white and

purified. At least Pliny mentions this; and it also would appear that Charles I had tablecloths made of it, which he also was accustomed to throw into the fire for the same purpose. More recently stockings and handkerchief were made in Elba of asbestos, as gifts to Napoleon I, while living there an exile. From time immemorial the peasantry, where it is found, in various countries, have turned it to economical use as an incombustible lampwick, for which purpose its power of capillary attraction admirably qualifies it.

Common asbestos, more or less fibrous, but of a powdery, brittle quality, is abundant in most countries, and begins to find its way into some of the industrial arts, but largely mixed with other materials. The strong, long, fibrous sorts, varying in color from pure white to dark brown, thus far are only found in sufficient quantity for commerce in the Italian Alps, at elevations of several thousand feet, and often, for much of the year, buried in the snow. They occur in serpentine rocks in irregular veins, usually very narrow, requiring much heavy labor and blasting to open. Sometimes, but very rarely, masses are found in one lump weighing several hundredweight. More frequently the veins prove very superficial, and give out almost at once. Then, again; they can be steadily worked for years, as they extend or penetrate into the mountains. Although some of these have been yielding as much fibre as there was a demand for since they were first opened in 1871-72, recently the increased call has led to the discovery of new productive veins of the very best quality, which will increase the outcome from a few scores of tons per annum to several hundreds. But the price, heretofore varying from £50 to £100 a ton, according to the quality and condition of the fibre, threatens to grow firmer, owing to the new uses now springing up for it, mostly based on patents, whilst Italian capitalists themselves begin to see the importance of a mineral, of which Italy has as yet a virtual monopoly, and are preparing to manufacture it on the spot where it is found in those goods which already find a steady and increasing demand.

These are chiefly, steam-packing in the rope or loose form for piston and pump rods, and stuffing boxes, and mill-boards for steam-joints, gaskets, man-hole plates, and a species of felting to cover boilers and steam-pipes. The ability of asbestos to resist an elevated temperature, moisture, friction and flame itself, joined to its lubricating quality, specially recommends it for the above purpose. The chief objection with the manufacturer is that, when properly prepared and applied, it lasts too long. As covering for boilers and pipes, it saves 25 per cent. or more of the waste heat; and in domestic uses in cellars, to prevent loss of heat by radiation, it is found to reduce the temperature of the cellar 15°, while raising that of the house abave 10°; *i. e.*, it saves the furnace or steam heat, and sends it where it is most wanted.

Asbestos lining or sheathing paper, especially for wooden houses, for ceilings, floors and partitions, to prevent the spreading of flames and make

each room fire-proof, is now attracting attention in America, and must recommend itself to builders generally, as rendering buildings not only safer from fires, but cooler in summer and warmer in winter, and free from insects that harbor in common papers. These papers are made in rolls of any thickness or length, and can be colored or printed with any desirable pattern. Fire-proof boxes for shelves in shops can also be made of this substance, and scenery for threaters, if fabricated of it, would be impervious to flames.

The varieties of abestos are quite astonishing to those who have not made a study of this mineral. No two localities seem to yield precisely similar fibre. In the cabinet of Mr. C. A. Wilson, Genoa, Italy, there are at least one hundred distinct varieties from the Alps alone; one specimen when taken out of the mine was 5 feet long, and weighed 700 pounds, of the most delicate cream color, and soft, like raw silk, after separating the fibres.

In America the asbestos business is mainly in the hands of a Boston company, protected by fifteen patents on various goods, and begins to assume a prosperous condition, calling for increased supply of the crude article, whilst in Great Britain it is chiefly centered in a flourishing Glasgow company, which was the first to risk the novel enterprise of trying to utilize a well-known mineral that has waited more than 2,000 years to become useful to men. In Paris it is begun to be adopted for civil and for public registers in the form of a fire-proof writing paper. Recently, patents have been taken out in America and England to cover its use as a fuel-bed for petroleum in any sort of stove or engine-furnace. It absorbs and retains the oil, its capillary attraction causing it to burn only on its surface, where it is under perfect control and gives out an intense heat. By a simple arrangement the hydrocarbons can further be converted into gas fuel, so it is claimed.

These fact would indicate that there is a business future for this mineral, and that new uses for it are likely to be discovered. The most beautiful varieties of the long, soft flexible and extremely fine fibers, commonly known as "floss," and which are more abundant than the strong, tenacious fibres, yet await a call in the industrial art.—*Iron.*

Fire-Proof Paper.—Asbestos is found in large quantities in the valley of Aosta, in the Italian Alps. A priest of Arezzo, named Victoria del Corana, has experimented with it in the paper-mills of Tivoli, and is now making a fire-proof fabric at a cost of four francs per kilogramme. The The most useful application which has yet been made of the paper is for the decoration of theatres.

Slates.—To test the absorptive capacity of a slate, it is a good plan to place it on edge in the water, leaving half of it above the surface. If the

water reaches the top within eight hours, it is porous to a degree. A good slate should not absorb more than one hundredth part of its weight after soaking for twelve hours in water. Slates of a crystalline formation are considered the best. The soundness of a slate can be tested by breaking it: if the fracture presents a splintered and ragged edge, it is sound slate; but if it breaks in a straight line, it is soft. It is said that the quality of slate for roofing improves as it is taken from a lower stratum.

GLYCERINE AS A LUBRICANT.—Chemically pure glycerine, free from water, is recommended as a lubricant for small machines and machinery parts where common oils and fats turn acid or hard, and so clog or smear. Glycerine is of particular suitability for sewing machines, as any accident with it is of less consequence than with oils which soon become dirty.

EDITORIAL NOTES.

ACADEMY OF SCIENCE. — The Kansas City Academy of Science, after the usual intermission during the heated term, resumed its monthly meetings, and held its September session, at its rooms, on the evening of the 25th inst., Hon. R. T. Van Horn in the chair, and J. M. Greenwood, secretary *pro tempore*.

A very interesting paper upon the "History of Alchemy" was read by Prof. T. J. Eaton, which will be published in the October number of the REVIEW, in full.

It was decided that the exploration of the mounds in Clay county, commenced last spring, should be resumed next month, under the direction of Judge E. P. West. The finances of the Academy are not in such condition as to bear a very heavy expenditure, and it is hoped that some of our wealthy citizens will feel impelled to contribute freely enough to this object to enable the Judge to perform his work thoroughly.

At the next meeting Prof. J. M. Greenwood will read an essay on Mathematics, and Prof. Crosby will exhibit the splendid collection of curiosities collected by him during his recent European tour.

MR. J. A. HAMBLETT has been for the past two weeks exhibiting the workings of the Telephone to our citizens, and has very successfully transmited oral messages between the Exposition grounds, the Coates House and the Western Union Telegraph office. Large numbers of ladies and gentlemen availed themselves of Mr. Hamblett's invitation to test the apparatus, and have expressed themselves greatly pleased with it. The Water-works company contemplate putting one in operation between their office and the pumping works up in West Kansas City.

It has been adopted in several of the Eastern cities between offices and factories, and also in some places between the offices of physicians and drug stores, and doubtless will become a much valued labor-saving machine.

AT THE RECENT EXPOSITION held in this city several collections of minerals and ores were exhibited, illustrative of the mineralogy of Missouri, Kansas and Colorado. That by the Missouri River, Fort Scott and Gulf R. R. Co. showed in a very attractive and instructive manner the lead, zinc and iron ores and

the coals, marbles, building stones and mineral paints of Southeastern Kansas and Southwestern Missouri, while those displayed by Mr. Curry, of Silverton, Colorado, illustrated in the most attractive and convincing manner the immense wealth of the San Juan region in gold, silver, lead and copper.

The fossils exhibited by Mr. Hare and Mr. Devens were nearly all illustrative of the geology of the region immediately in the vicinity of this city, and prove to those interested in such matters that this field is one well worthy of careful study and research.

THE AMERICAN ASSOCIATION for the advancement of Science met at Nashville, August 29th, and continued in session four days.

Among the members who were elected Fellows of the association were our late fellow citizen Octave Chanute, Esq., and Prof. Paul Schweitzer, of Columbia, Mo.

The following officers were elected for the ensuing year, viz: President, Prof. O. C. Marsh, of Yale College; Prof. R. H. Thurston, Vice President of the Physical Section; Prof. A. R. Grote, Vice President of the Section of Natural History; Prof. H. C. Bolton, Vice President; General Secretary Prof. F. E. Nipher, of St. Louis University, Secretary of Section A; Geo. Little, of Atlanta, Ga., Secretary of Section B; Wm. S. Vaux, Treasurer; Prof. F. W. Clarke, Chairman of Chemical Section C; Henry Wheatland and Samuel H. Scudder, Auditing Committee.

Professor Marsh's paper on the "Introduction and Succession of Vertebrate Life in America," as well as other most interesting papers by Prof. Daniel Wilson, Chairman of the Subsection of Anthropology, Prof. Isawa, of Japan, Prof. Mallory, Prof. J. W. Osborne, and Prof. F. C. Mendenhall, were read and most of them published in the New York *Tribune*. The next meeting of the association will be held in St. Louis, in August, 1878.

MR. EDWIN SHINN, route agent on the Western Division of the Kansas Pacific Railway, while out hunting antelope on Bijou creek, about sixty-five miles northeast of Denver City, Colorado, had the good fortune to find a portion of the leg bone of a mastodon. Being an enthusiast on such subjects, Mr. Shinn was much elated by his discovery and brought the relic to this city at once, where it has been for some time on exhibition at the the rooms of the Academy of Science.

When found it measured over twenty inches in length, but about eight inches, being much decayed, crumbled away. The remaining portion weighs 13 pounds, measures 12 inches in length and 29½ inches around the upper end. It is in an excellent state of preservation and shows the roughened surfaces for the attachments of the muscles as distinctly as if prepared by an anatomist but a few months ago. Doubtless the whole skeleton lies imbedded in the sands of the Bijou creek and may be found by a diligent and well directed search.

IN explanation of the unusual delay in issuing the present number of the REVIEW, we can only offer the excuse that the occurrence of the Kansas City Exposition in September absorbed about two weeks of the time of the editor, printers and binders, to the exclusion of almost everything else, an excuse which all who attended the Exposition and saw how completely our citizens devoted themselves to it, will accept as valid and sufficient.

THE exploring party sent out by the Kansas State University during the past summer, according to *Harper's Weekly*, discovered a number of a very rare species of beetle of the genus *Amblychila*, the acquisition of which has long been an object by collectors of coleoptera. For the purpose of securing funds to defray the expenses of their explorations, the authorities of the university offer specimens for sale at a moderate price.

STANLEY "AFRICANUS" has followed up his explorations with such perseverance, energy and courage as to have perfected the work of Livingstone and Cameron in Central Africa by proving that the rivers Lualaba and Congo are one and the same stream; which places him at the head of living explorers.

DR. SCHLIEMANN has offered to present his collection of Trojan curiosities to the South

Kensington Museum, London. These curiosities belong to the prehistoric period, and consist of reliefs taken from the five cities on the hill or plateau of Hassarlik. This collection is altogether unequalled, for, with the exception of two goblets found in the tomb of the kings of Mycenæ, nothing of the kind has ever been discovered.

THIS month has been characterized by an unusual amount of meteorological disturbances in various parts of the world, among which we note earthquakes and volcanic eruptions along the Pacific coast of South America, a few smaller shakes in different portions of the United States, storms and cyclones on the Gulf of Mexico and across the central portion of United States from St. Louis to Pittsburgh.

Cotopaxi, the highest active volcano in the world, has recently experienced a violent eruption, accompanied by most destructive floods of water, which, pouring out from the craters, drowned not less than one thousand persons. The event occurred on the 26th of July. Enormous quantities of ashes and cinders fell upon the surrounding country. Over two thousand heads of cattle were destroyed, and the loss of smaller animals was much greater. There was a great eruption of Cotopaxi in 1768; also in 1855, and one in 1856.

PROF. MUDGE, of Kansas, writes to us from Manhattan on the 15th, announcing that he has, during the past summer, which he has spent in Colorado, "had very fine success in obtaining some new gigantic Dinosaurs."

BOOK NOTICES.

POPULAR SCIENCE MONTHLY. We have just received the October number of the Popular Science Monthly, published by D. Appleton & Co., New York. Price, $5 per annum.

Its contents for October are as follows: Bathybius and the Moners, by Prof. Ernst Haeckel. Molecular Magnitude, by L. R. Curtiss. Simple Experiments in Optics, by Eliza A. Youmans, illustrated. On Elementary Instruction in Physiology, by T. H. Huxley, F. R. S. Cosmic and Organic Evolution, by Lester F. Ward, A. M. Pessimism and its Antidote, by Charles Nisbet. The Modern Piano-Forte, by S. Austin Pearce, Mus. Doc. Oxon. Snoring, and How to Stop It, by John A. Wyeth, M. D., illustrated. Mars and its Satellites, by Prof. Daniel Kirkwood. Huxley's American Lectures, by Prof. E. Ray Lankester. Specimens of Educational Literature, by F. W. Clarke, illustrated. The Psycho-Physiological Sciences, by Joseph Rodes Buchanan, M. D. The Decline of Party Government, by Prof. Goldwin Smith. Sketch of Prof. Jevons, with portrait. Correspondence, Editor's Table, Literary Notices, Popular Miscellany, Notes, making a most interesting and valuable number.

THE POPULAR SCIENCE MONTHLY, SUPPLEMENT, No. 5; D. Appleton & Co., New York, 96 pp., octavo, 25c.

After an existence of only five months this valuable "annex" to the Popular Science Monthly has become a permanent success, almost, if not quite, as indispensable as the original magazine. It is made up of selections from the writings of the foremost scholars and workers of the world, culled from the very best periodicals published on either side of the ocean, and fully carries out the objects of the publishers, who announced that it would "represent the course of contemporary thought on on subjects of leading interest, preserve its most permanent elements and form a comprehensive and independent scientific library."

THE GARDENER'S MONTHLY AND HORTICULTURIST, edited by Thomas Meehan, vol. xix, No. 225, September, 1877; Chas. H. Marot, Philadelphia, Pa.; monthly, 72 pp., octavo. $2.10 per annum, post paid.

This old friend makes its appearance with the greatest punctuality every month, with a table of contents as fresh as spring and almost as comprehensive as an encyclopædia. One of its most marked features, aside from the able articles of its learned editor, is its host of letters from all portions of the world, written for the most part by experts in horticulture and floriculture. It will pay any one who loves flowers and trees to subscribe for and read it.

THE LOCUST PLAGUE IN THE UNITED STATES, by Chas. V. Riley, M. A., Ph. D., with 45 illustrations; Chicago, Rand, McNally & Co., 1877, pp. 236, ducd. $1.

This work is a condensation of all the articles, essays and reports made by its indefatigable author during the past three years, including some made during the investigations of the committee appointed by Congress, of which the author was and is a member, with practical recommendations for the destruction of the pest. It deserves a wide circulation, especially among agriculturists.

THE SCIENTIFIC AMERICAN, Munn & Co., N. Y.; weekly, large quarto, illustrated, $3.20 per annum.

It is useless to undertake a description of this most valuable periodical, which, with its Supplement, is a household word among mechanics, artisans and scientific men of all classes. To those who are not acquainted with it we can only say, send ten cents to the publishers and get a copy as soon as you can.

VAN NOSTRAND'S ENGINEERING MAGAZINE, October, 1877, No. 106, Vol. 17, D. Van Nostrand, N. Y., pp. 96, large octavo, $5 per annum.

This is probably the most purely and strictly scientific magazine published in this country, and judging from the greatly increased number of original articles in the present number, it is rapidly becoming the exponent of the mathematicians, engineers and metallurgists of the country; there being no less than seven original articles in this number, besides about ten pages of reports, editorials, etc.

THE NORTH AMERICAN REVIEW, September and October, 1877, No. 258, third edition, pp 204; J. R. Osgood & Co., Boston. $5 per annum.

The captivating article in this number is that on The "Electoral Conspiracy" Bubble exploded, by Judge E. W. Stoughton, written in reply to that of Judge Jere Black in the previous number, though there are many others by eminent writers, such as Dion Boucicault, General McClellan, Emerson, David A. Wells, E. L. Burlingame, "A. Striker," Felix Adler, and Thos. A. Scott. Being one of the oldest American periodicals, is is almost unnecessary to say that it is one of the most substantial and reliable.

WE are much gratified to receive from H. O. Houghton & Co., Boston, the AMERICAN NATURALIST in exchange. It is an 84 paged illustrated monthly magazine, devoted especially to Natural History, Geography and Microscopy, but at the same time containing first-class articles upon all the topics of scientific inquiry. It is edited by Prof. A. S. Packard, Jr., whose connection with it alone insures the utmost care and accuracy in every department, while the list of contributors numbers such eminent naturalists as Profs. Asa Gray, J. D. Whitney, O. C. Marsh, A. Agassiz, F. V. Hayden and more than twenty others of the leading scientific investigators and writers of this country and England. Price, $5 per annum; single numbers 35c.

THE KANSAS EDITORS' ANNUAL for the year 1877, Kansas Publishing House, Topeka, Kansas, 1877, 54 pp. octavo.

This is a very neat pamphlet containing the proceedings of the annual meeting of the State Editorial Association, its by-laws and constitution, the Annual address by Capt. King, of Topeka; also a sketch of the excursion to Colorado, by the same elegant and fascinating writer, the sermon on "Human Reason and Christian Faith," by Rev. John A. Anderson, of Manhattan, and a list of the newspapers published in the state.

WE have also received copies of the latest numbers of the following scientific and literary periodicals: The Popular Science Monthly: The American Naturalist; The Sanitarian; The Phrenological Journal; The Monthly Weather Record; Mines, Metals and Arts; The London Telegraphic Journal; The London Journal of Applied Sciences; The Kansas Farmer; The Western Agriculturist; The Illustrated Journal of Agriculture; The Fruit Recorder; The Industrialist; The Library Table; The Publishers' Monthly; The Brookfield Gazette; Osage City Free Press; The Miami Republican; Leavenworth Daily Times; St. Louis Weekly Times; also The Biennial Catalogue of the Kansas State Agricultural College 1875-1877; Foster on Animal Vaccination; Circular No. 8 from the Surgeon General's office, a Report on the Hygiene of the United States Army, 568 pp., quarto; Seventh Annual Report of Water-Works Commissioners, Columbus, Ohio.